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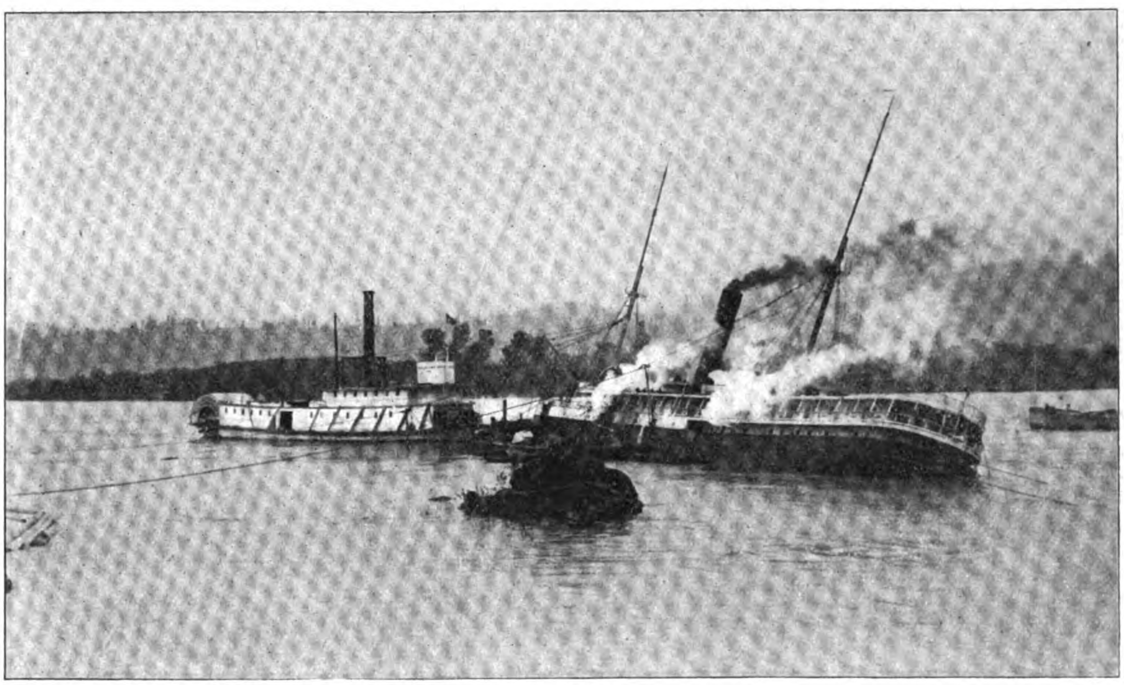
WRECKING THE GEORGE W. ELDER.

The successful raising of the steamer George W. Elder by Capt. Harris W. Baker, of Detroit, Mich., will probably be remembered for many years on the Pacific coast as a most extraordinary exploit. The Elder, which was owned by the O. R. & N. Steam Navigation Co., the marine end of the Oregon Short Line, sank on Jan. 21, and was purchased by J. H. Petersen, of Portland, Ore., for $10,400, a man who has made millions in bold commercial ventures. Petersen started to wreck her himself. He built large pontoons, 20 ft. by 40 ft. in size, completing two of them and partially completing two more. After losing one of his pontoons which was later discovered

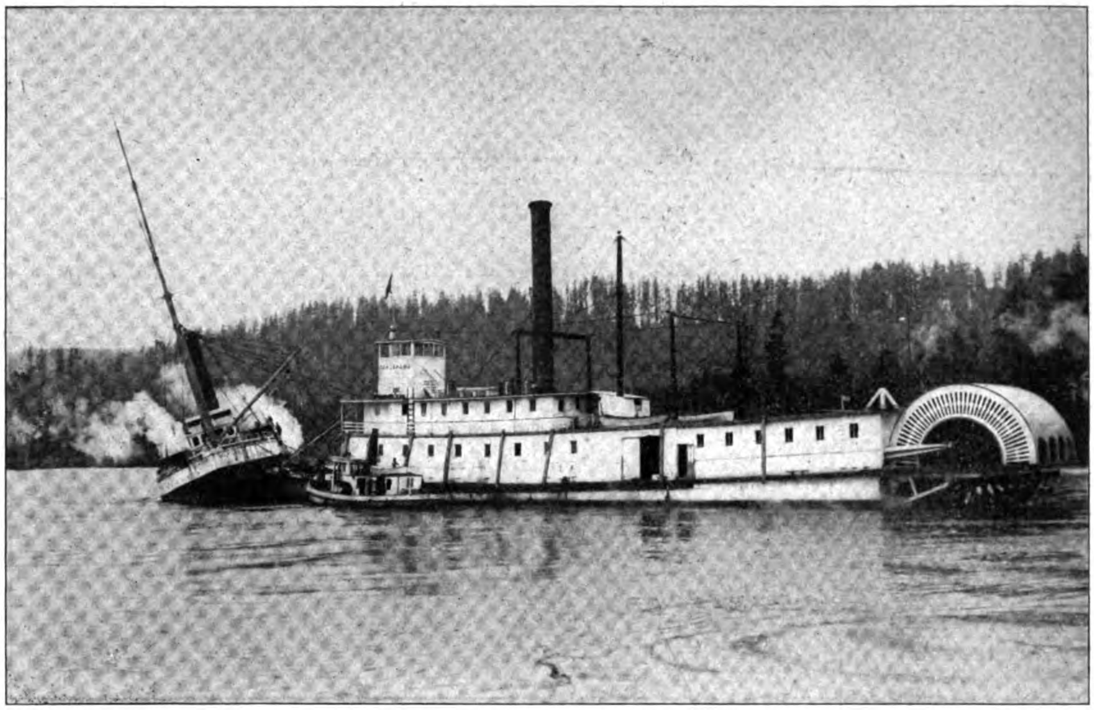


THE STEAMER GEORGE W. ELDER ON THE ROCKS.

1905, in the Columbia river, securely imprisoning herself on jagged rocks in 16 ft. of water. Her owners took off the cargo between decks and undertook to wreck her, but failing in the effort abandoned her to the underwriters. The underwriters then sent a wrecking master from New York who worked on her for about seven months, trying different methods of raising her but failing in all of them. When he started on her he found that he could pump the after compartments out but in settling later she tore herself and the after compartments filled again. It was then discovered that her after compartments could could not again be pumped out and after expending $51,000 upon her the underwriters abandoned her altogether.

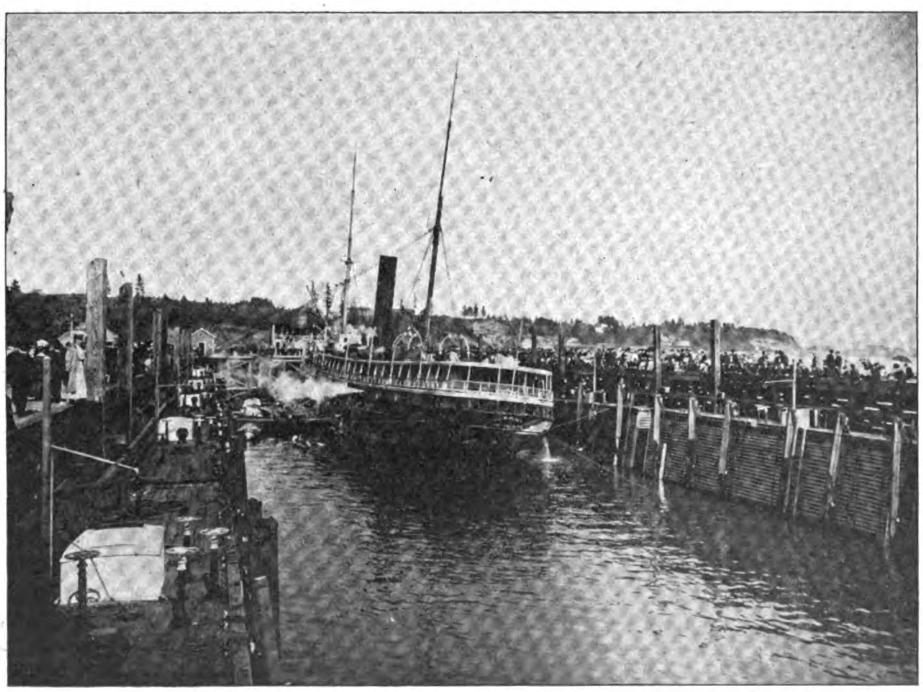
The steamer was auctioned off to the highest bidder sunk under the bow of the boat, he gave up the job of attempting to raise her and concluded to blow her up after getting the machinery out of her. It was at this time that Mr. J. W. Snyder, of Bay City, Mich., who was visiting Portland, became interested in the wreck and told Petersen that he knew a man who could raise her. Petersen doubted the statement very much when Snyder mentioned a lake man. He finally authorized Snyder, however, to talk the subject over with Capt. Baker. Capt. Baker went to Portland with one of his divers and made an examination of the vessel and cargo. This examination was attended with great difficulty because the cargo was completely submerged and the water was as black as mud. It was conducted entirely by feeling. Capt. Baker was satisfied

from the examination that he could raise her and made a contract for the delivery of the Elder afloat in the dock with the understanding that he was to receive no compensation whatever if he failed to deliver the vessel in dry dock. He left Detroit on Feb. 21, 1906, with seven men, sending steam pumps and diving outfit by rail in advance.



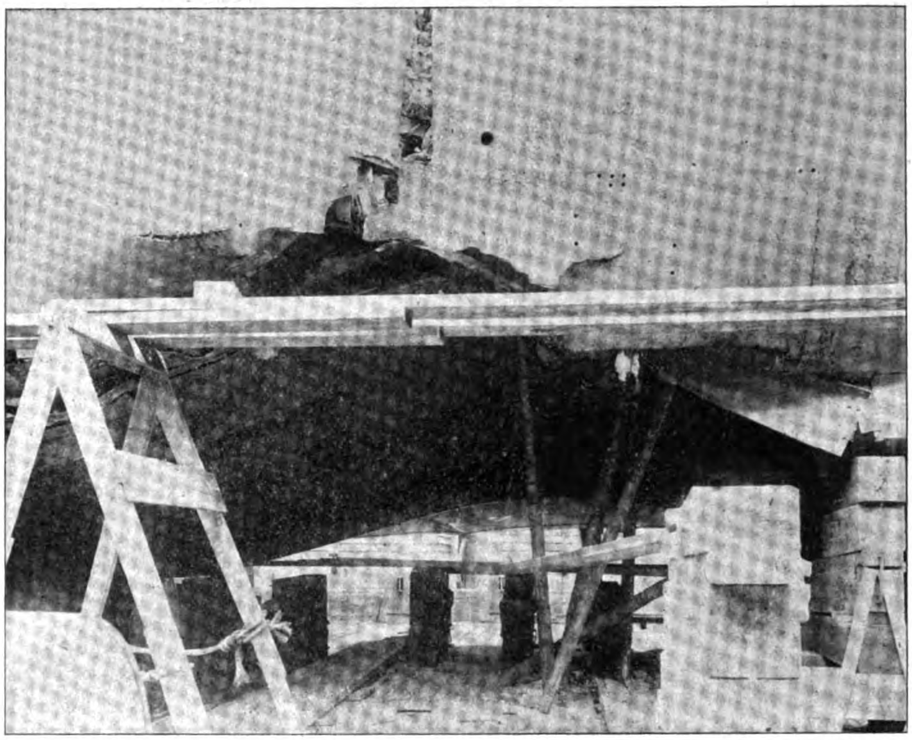
PREPARING TO TOW THE ELDER INTO PORT.

The first thing to be done was to clean out the cargo which consisted of oats, bran, middlings, flour and paper. The removal of the paper was a problem. It could not be pumped as the string clogged the machinery. There was so much of this string that Capt. Baker almost concluded at one time that the entire cargo consisted of it. It was finally necessary to remove the paper by hand. It was also found necessary to pump 110 tons of soft coal out of the reserve bunker, making a very nasty job of pumping. A break was found in the bulkhead of this compartment, making it clear why the previous wrecker could not pump the after hold out a second time. When the hold was cleared out the wreckers found a rock in her 8 by 9 ft., as they then supposed, but after getting her in dock the rock was found to have extended 36 ft. fore and aft and 34 ft. athwartships, projecting up into the hold to a height of 10 ft. 8 in. This great hole began 84 ft. aft of the bow, running aft. The position of the steamer was discovered to be thus: She was resting upon two rocks, one forward and one aft with deep water amidships. The rock aft was perfectly smooth and flat, and the steamer's stern overhung it 84 ft. with 65 ft. of water underneath the overhang. No injury was inflicted upon the steamer at all aft by this rock. The rock forward was jagged and had penetrated into the hold to a height of 10 ft. 3 in. After removing her cargo Capt. Baker built bulkheads in her, one forward of the break and one aft of the break, and two aft of the engine room. Work was then started upon patching up the holes. Every inch of the vessel's hull was explored by feeling and so thoroughly was the work done by the crew that when she got into dry dock Capt. Baker could not discover in her a hole as big as the point of a lead pencil.



THE ELDER SHORTLY AFTER SHE ENTERED DRY DOCK.

The great work, of course, was patching up the hole caused by the rock forward. Capt. Baker decided that

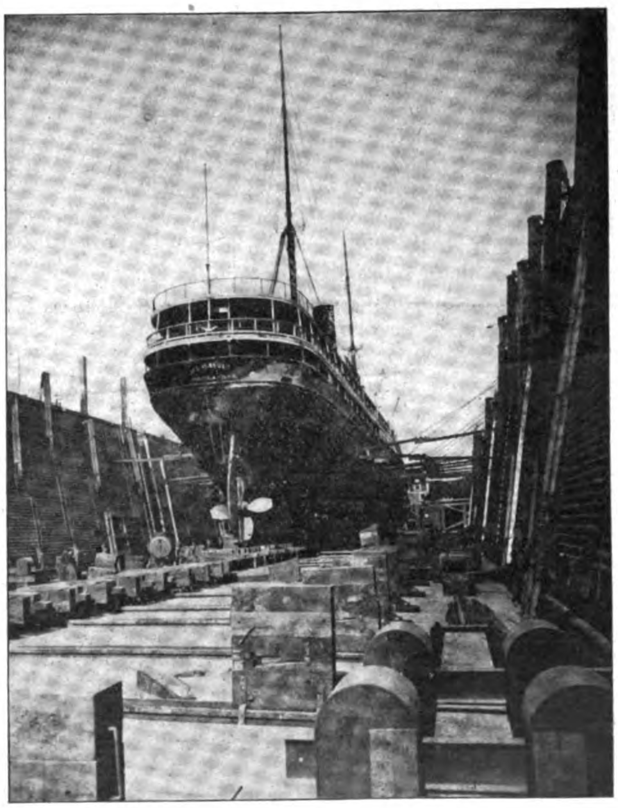


THE CONCRETE WELD UNDER THE BREAK FORWARD. THE BROKEN PLATES IN THE STEAMER'S SIDE ABOVE THE BREAK WERE CAUSED BY SUBSEQUENT STRAINS IN DRY DOCK.

the only way that this could be done was by capping the rock with concrete. Canvas was used to separate the concrete from the rock itself. The water was like mud and the divers were unable to see a thing. The cement was sent down a chute in burlap sacks and the stone in a box. A diver at the foot of the chute received the material and carried it to another diver who mixed it on the spot and applied it instantly. Naturally he could not stir from his location because, having no sense of direction in the total darkness, he would have been unable to know where he left off. After twenty-two days of continuous labor everything around the rock was made perfectly tight. It had taken 325 barrels of cement and 700 lbs. of broken rock to form the concrete stop in the great break. A box 4 ft. wide., 18 in. deep and 33 ft. long, filled with cement, was then laid athwartships across the concrete structure to act as a strong back. The concrete really formed a solid wall 10 ft. high around the rock with a great beam of the same material athwartships. Eight or ten other holes were then patched up, including a vicious break at the bow. The steamer had struck her fore foot first and had jammed her keel considerably to starboard for a distance of 12 ft. This break was also filled with concrete.

The location of the steamer was a most dangerous one. The river, which has an average depth of over 100 ft. at this point, has a current running about six miles an hour. The great ledge of rock, rising to within 15 or 18 ft. of the surface, causes a local increase of speed, so that the current adjacent to the steamer is practically 15 miles an hour. The steamer also had a list of 12 ft. to starboard. In order to hold her securely in her place while she was being wrecked, Capt. Baker ran two 8-in. hawsers with heavy cables attached from her foremast and mainmast head to the rocks on the shore. These were used to help in uprighting her when pumping was started. Two heavy 9-in. hawsers with a severe strain upon them ran from the port side of the steamer to large rocks sticking out of water. Four anchors were also out, two from each quarter and two from the stern, with 8-in. hawsers under heavy strain. By these means she was held rigid on the rocks until she should lift clear. As all vessels have a tendency to rise aft first, and as Capt. Baker of all things, did not want her to plunge by any displacement of weight into deep water, he arranged his pumps so that the discharge from the forward hold could be emptied into the after hold or overboard at will. It was found necessary, in order to keep her even, to transfer a considerable amount of water from the forward hold to the after hold. Before pumping began lines had been made fast to the tow boats Harvest Queen, Oklahoma and Henderson and the tug McCracken. After the pumps had been working about an hour she rose so easily and so evenly that a number of men on her upper deck were not aware that she was afloat until cheers from the thousands that were lining the shores made them aware of that fact. The whole maritime community of the Pacific coast was deeply interested in the progress of Capt. Baker's work and some had come even from San Francisco to see her raised.

The steamer was released from the rock at dusk and



THE ELDER SAFELY ON THE BLOCKS.

Capt. Baker beached her on a sand island about a half mile away for the night. The divers then made a further examination of her hull to see that everything was tight

CAPT. HARRIS W. BAKER'S FAMOUS CREW.—THOMAS MULHOLLAND, W. P. MCMULLEN, JUDSON TOFFLEMIRE, LEVI MCKENZIE, H. MCKAY, CAPT. H. W. BAKER, DAVID BEAUDRY.

and she was started in tow of the Harvest Queen and Oklahoma for the dry dock at St. Johns, Wash., four miles below Portland and about forty miles from the scene of the wreck. The tow boats could only pull her at the rate of 3½ miles an hour. Capt. Baker had previously been assured that the dry dock would be ready for his reception but when he got the Elder there it was occupied and he was compelled to hold her for seventy hours before docking. This was about as trying an ordeal as a man could go through. Capt. Baker's contract called for delivery of the ship afloat in dry dock. The moment that she entered, of course, he concluded the letter of his contract but as she was listed somewhat he volunteered to help in getting her on the keel blocks. His own crew remedied the list and his divers adjusted the keel blocks.

After the dock was pumped out and the terrible nature of the Elder's injuries perceived, congratulations poured in upon Capt. Baker from all sources. Thousands visited the vessel and begged permission to personally examine the concrete weld in her break. Capt. Baker persuaded the dry dock officials to permit this. Ropes were stretched around the hull and a constant procession of people descended into the dock and examined the break. Capt. Baker said it was almost like a reception.

Capt. Baker left Detroit on Feb. 21, he began actual wrecking work on March 10 and concluded it May 23. Petersen had paid $10,400 for the steamer; he spent probably $18,000 more in his own wrecking operations; he paid Capt. Baker $30,000 for his work, making the total cost of the Elder to him about $59,000. He has been offered a profit of $79,000 clear for the steamer but wants $100,000. The Elder in a completed state is probably worth about $175,000. Capt. Baker's crew worked with great loyalty. During the pumping, towing and docking of the steamer they worked practically without sleep for three days. In consideration of their fidelity Capt. Baker, as soon as the steamer was successfully docked, made a present of $100 to each member of his crew.

CREW RESCUED AT SEA.

Among the passengers who crossed on the Allan mail steamship, Ionian, on the first trip to Montreal, for this season, last month (May) was Mr. J. H. Donneley, of Winnipeg, Manitoba. Mr. Donneley tells a most graphic story of the great liner, in mid-ocean, resplendent in her strength, and the ill-fated Norwegian barque, Trio, dismantled, drifting, sinking inch by inch, soon to be engulfed in the fathomless abyss; of how the sailor lads of the Ionian came to the rescue of the despairing crew of the Trio,—a most interesting page added to the history of the deep.

I had the good fortune to be a passenger on the Ionian at the time, when on the night of May 22, while listening to the sound of music, song and story, wafted above by the slight breeze, the reverie of the lookout was disturbed by a light on the ocean dimly burning. Was it a light?. Yes! No! Yes! The night was rough and squally. The warning was given instantly; every one was on the alert. As we drew nearer the light disappeared. The captain then went to the bridge and ordered the course of the ship altered. Wonderment was stamped on the face of all passengers, then of a sudden a stream of fire and light soared upward, lighting up the heavens. This was a distress rocket. Both watches were ordered to stay on deck. The Morse telegraph code was then brought into play. The light ahead flickered and then went out. The chief officer turned sharply to the grizzled old boatswain, and issued a quick order.

Instantly the silvery notes of the pipe resounded through the sleeping ship. The sailors ran here and there smartly and silently on the deck. "Heave ahoy the forward starboard boat," was the next order. This was swiftly accomplished. "Volunteers", shouted the mate. Immediately, be it said to their credit, Quartermasters Mitchell and Sinot leaped into the boat, quickly followed by seamen Edge, Sones, Fleming, Benson and Kennedy, and second officer of the Ionian, Miller,—fine types of sailors, all of them. Those who witnessed this spectacle will never forget the wierd scene. The stern-faced, life-belted quartermaster at the boat's end, the seated, ready seamen, the resolute face of the officer in charge, a fierce, gloomy, storm-tossed sea below; the inky sky, the

moaning wind, beyond the uncertain headlight on the doomed vessel, all combined to make an impression never to be forgotten. "Lower away," is the next order given. The life-boat dropped swiftly into the dark abyss, which caught the boat in her fierce embrace, and with a wild heave the boat is tossed on the crest of an enormous sea, then swallowed up by the gloom of the night. By this time the decks were crowded with passengers of both sexes, all partially dressed. Half an hour passed without sound or sight of the men who left the vessel. "God send the brave hearts safely back," was the unspoken prayer of the multitude, for never did men risk their lives more generously than did these brave fellows. The captain paced the bridge restlessly, while the Ionian rolled ponderously upon the heaving waters. "Stand by to lower another boat," came from the captain's lips. Instantly another crew took their stations by their boat ready to embark upon a second attempt. This was unnecessary, for out of the darkness came a shout of "Ship ahoy." Then, "We cannot get near the distressed vessel for wreckage," roared the voice of the officer. Will you stand by her till daylight, till we make another attempt, now in this darkness and rough sea, it is impossible.

"Very well," said the Captain, "come on board." The boat dashed violently against the ship's side several times, and after some dangerous work was brought on board. All through the darkness the great liner lay head-on the wild sea, riding like a sea-gull.

At daylight the life-boat started away again with the same crew, and by wondrous skill again got clear. This attempt was completely successful. We could see her hovering around the stricken barque, taking her crew when they could, the doomed ship tossing and plunging against the cold, gray sky. Then the life-boat's head was turned homeward. They had rescued everyone of the crew, fifteen in all.

The vessel proved to be the barque, Trio, of Lonsberg, thirty-one days out, and dismasted eleven, and absolutely at the mercy of the sea.

One of the Ionian's seamen, Kennedy, was injured, being thrown violently backward by the sea. The Norwegian sailors were soon aboard the Ionian, and were received amid the cheers and acclamations of the passengers. The rescued were speedily made comfortable, and their gallant rescuers went about their duty as if nothing unusual had happened.

Let us hope that the Norwegian government may recognize those noble and heroic spirits, who so bravely risked their lives to save those of their suffering fellow creatures. It speaks well of the Ionian's officers and crew. Their promptitude and discipline was magnificent.

MACHINE TO COMPUTE TIDE.

A machine to facilitate the computation of the tides for a year in advance has lately been installed in the office of the Coast Survey Service at Washington and has simplified this difficult task very greatly. This machine takes into account nineteen factors in tide computation, and when these are duly recorded on its nineteen dials at the starting point, the balance of the computation for every day in the year becomes a quick mechanical process. The machine does the work more accurately than when done by computers—as the element of human fallibility does not enter into its work. The first thing to do in computing the tides is to plot, in co-ordinate curves, the results of a long series of observations of tides at the particular place. These show the tides as they are. The astronomical elements are known and if these be subtracted the remainder will be the total of all the other causes (inertia, etc.). To get at the other elements involved, long series of observations must be made to calculate the prevailing weather. When that is eliminated the calculator can determine in what respect the tide is affected by the land configuration, depth of water, etc.

SUEZ CANAL COMPANY.

The annual report of the directors of the Suez Canal Co. states that the traffic on the canal, which was exceptionally active during the first months of 1905, subsequently showed a slight decrease for the year. The receipts declined about 2,100,000f. If it was considered that 1904 had benefited by one of the most considerable increases the company had to record, and followed a series of years during which the progression of the receipts had been almost uninterrupted, the results of last year might be considered as entirely satisfactory. Those results permitted the company to maintain at 141f. net the amount of the dividend, and to make a further appropriation of three millions to the special reserve, to which five millions were applied in 1904, in order to meet the reduction of 75 centimes per ton effected from Jan. 1 last.

The total receipts last year amounted to 117,308,196f. 82c., which showed, compared with those for 1904, a diminution of 1,868,201f. 63c. The total expenses, which amounted to the sum of 40,984,184f. 48c., comprised 4,000,000f. for amortization and 250,000f. for the insurance fund, and were 54,285f. 86c. less than in 1904. The balance of receipts over expenditure showed a diminution of 1,813,915f. 11c. on 1904, and amounted to 76,324,012f. 34c., or after an appropriation of 3 per cent or 2,289,720f. 37c. to the statutory reserve, 74,034,291f. 97c., which, with 154,901f. 93c. brought over from 1904, amounted to a net sum of 74,189,193f. 96c. The company proposed to fix at 71,173,-521f. 12c. the profits to be distributed and to carry 3,000,-000f. to the special reserve, leaving a balance of 16,672f. 18c., and making up the total sum of 74,189,193f. 90c.

By the distribution of 71,173,521f. 12c., the dividend to shareholders came out at 126f. 33 1-3c. per share, representing with the interest of 5 per cent on capital, a gross dividend of 151f. 33 1-3c., or 141f. net.

During the year 1905 4,116 vessels, representing a tonnage of 13,134,105 tons, passed through the canal. Compared with 1904, there was a decrease of 121 ships and 267,730 tons, all in merchant shipping. The average tonnage per ship, which had remained stationary in 1904, rose from 3,163 tons to 3,191 in 1905. The company had frequently remarked on the importance for the canal traffic, and the influence exercised on the receipts, by the increase in the average tonnage of vessels. It was only by looking back that an idea might be formed of the transformation that had been gradually accomplished. In 1885 the average tonnage was 1,748 tons; in 20 years it had increased about 80 per cent. Notwithstanding the increase in the dimensions of the ships using the canal, the navigation, by means of the works carried out, had been rendered safer and more easy. The decrease in the number of groundings furnish proof of the improvements realized. The proportion of groundings to the number of vessels passing was in 1885 43 per 1,000, and it was only 17 per 1,000 in 1905.

The company had just ordered a second tug similar to the one in service since 1899, and they would, therefore soon have at each extremity of the canal a vessel of great power, able in cases of grounding to afford rapid and efficient assistance to ships.

The traffic on the canal was disturbed in 1905 by an event of exceptional gravity. A fire broke out on Sept. 5 on the steamer Chatham, the cargo of which comprised about 80 tons of dynamite and 120 kilogrammes of detonators. The fire could only be overcome by flooding the hold in which it was burning, and in consequence of the giving way of the bulkheads the ship sank in a short time. With great precaution navigation was carried on by day alongside of the wreck, and steps were at first

taken to facilitate it by dredgings rapidly executed over a distance of 500 meters to widen the channel. While that work was going on it was ascertained by consultation with the most eminent scientific authorities that the only means of removing such a formidable obstacle was by blowing it up. Preliminary measures were adopted to minimize, as far as possible, any damage, and the explosion took place on Sept. 28. Work was immediately begun to repair the effect of the explosion. The progress of the dredgers employed in the work was constantly impeded by pieces of iron, the removal of which caused sometimes delays of two or three hours. The excavations on the African side of the canal opened a passage of a width of 35 meters, and a depth of nine. To obtain that result 18,000 metres cube of sand had to be excavated: and about 400 tons of iron in pieces of a weight of from 1 cwt. to 20 tons had to be removed. Between Oct. 8 and 11 all the vessels that had been stopped from the time of the explosion effected their passage. In four days 109 ships, 53 from the north and 56 from the south, passed through the canal without incident of any kind. The accident to the Chatham not only gave rise to great difficulties, and for some days to keen anxiety, but it had the happy effect of demonstrating the resources of the company. It also brought to light the merit and devotedness of the company's staff.

The canal, as well as the channel of Port Said, was preserved in a good state of navigability, in 1905, by the construction of 97,353 metres cube of dry embankment and 2,772,205 of dredging, of which 1,354,588 were in the canal proper, and 1,417,517 at Port Said. To maintain the canal at its proper depth the dredging was carried to a depth of 10 metres, and since the commencement of the present year to 10½ metres, to permit vessels of a maximum draught of 8.23 metres to make the passage in safety. The company hoped at a not distant date to increase the maximum still further. The company had now at its disposal two powerful hopper dredgers, the Puissante and the Ptoleme. The latter, which was built by Messrs. Lobnitz & Co., of Renfrew, had been in use since September last and appeared likely to give every satisfaction.

The board was authorized in 1901 to raise a loan of 25 million francs for works of improvement in the canal. At the end of December last only 12,867,000f. had been employed, but contracts had been entered into that would involve a further outlay of about as much, and shareholders were asked to authorize an increase of the limit of borrowing powers from 25 to 50 million francs.

The development of the regular maritime services, due to the expansion of trade between the west and Oriental countries, had largely contributed to the increase of the traffic in 1905. In an appreciable measure, but less than in 1904, the traffic had also benefited by the exceptional elements that contributed to the activity of the movement during the preceding year. Particularly the shipments of coal for the fleets engaged in the Russo-Japanese war furnished an important item in the first months of last year. Another important element of the traffic in 1904—the exportation of wheat from India to Europe—continued in 1905, and to such a degree that the tonnage available was insufficient, and ships had to be sent north to south in ballast. The exportation of wheat declined in the second half of the year, and during the last quarter fell below the average. The traffic during the first quarter of the present year showed remarkable activity. Due in great part to a normal extension of the commercial services, it was also accentuated by the repatriation of Russian troops.

On May 24 the receipts, affected by the reduction of 75c. per ton since Jan. 1, showed a decrease of 2,400,000f., but account must be taken of the fact that in the first four months of 1905 they were exceptionally large. The daily average during that period of 1905 was 346,000f., but for the last eight months it was only 293,000f. The present situation, therefore, appeared quite satisfactory, and the known results, as well as those that might be reasonably expected, fully justified the decision to reduce the charge by 75c. in the tolls.

Since the last general meeting the board had to deplore the death of four of their colleagues—MM. Boucard (one of the vice presidents), Armand Viellard, Jules Cambefort, and Darier. The board had appointed to the vacant seats, subject to the ratification of the meeting, Vice Admiral Human, MM. Stephane Derville (former president of the Paris Tribunal of Commerce, and chairman of the Lyons Railway Co.), Andre Lebon (formerly minister of the colonies, and now chairman of the Messageries Maritimes Co.), and Georges Devin (former president of the order of advocates to the council of state and court of cessation). The four directors who retired by rotation were MM. E. Daubree, L. H. Ruyssenaers, M. C. Verge, and Sir Thomas Sutherland. They were eligible for reelection.

OUR MERCHANT MARINE.*

BY REAR ADMIRAL J. B. COGHLAN.

I wish particularly this evening to invite the attention of you gentlemen to what I think is a very serious need of our country at the present time, from various points of view, and that is a merchant marine of our own. Of course it does not become a naval officer to point out a way by which we can have a merchant marine. That belongs to the executive and legislative departments of the government. We can only say to you that from our point of view (and I think it is our duty to study all the needs of the navy, as it is for your protection) it is our duty to point out to you the fact that from a naval point of view we need a merchant marine. You must remember that we will hardly ever keep in active service at one time more than three-fifths of the total number of our war vessels. That three-fifths that we now have in commission almost exhaust the sailor men that we have in the country, and we are obliged to go away back and get fresh water sailors from the farms, at that, and bring them to our ships and make man-o'-warsmen of them. I will say, and I am very glad to say it, that we do get some of the finest enlisted men from that source that any nation in the world can have. They are mostly young, bright, intelligent American boys who are amenable to discipline and can be instructed easily, and in the course of a couple of years they have the sea habit sufficiently developed to make them first rate men. There seems to be something in the atmosphere of our country that teaches them to look straight when you get them looking over a gun or through a gun-sight. When they do that they look straight, and that is what we want. Perhaps some of you may have noticed this morning in the *New York Herald* a report of the result of our last practice on looking straight through the gun-sights. Two or three years ago the average of shots from our larger guns, 12 and 13 inch, was about one shot in two minutes, 45 seconds, this fall we averaged three shots per minute from each of those guns, and three hits. I do not know—I may know, but I will not tell if I do—what is the exact average of

*Delivered at a banquet of the National Association of Manufacturers.

shots in other navies, but I can say this much, that as long as our people keep on as they are, you can sleep quietly at night in case you send these fellows out to fight.

But the merchant marine, I think, is needed, not only for our commerce but for the navy, because in time of war when we put the whole fleet into active service, we will have more than double the number of men that we have in times of peace and the great question with the navy men is where we will get those other men. You cannot make a sailor over night. It takes two years at least to bring a bright young man up to the position where he is worth anything at all to the service, and if we have to double the number of men that we now have, where are we going to look for them? There are a lot of men training in the naval reserve. That will give us some men, but that will give us but a very, very small number compared to the whole number required. In time of war, with what ships we have authorized already by congress, and taking into consideration the number of auxiliaries we shall require, I am almost afraid to tell you the number of men we shall probably want, but it is so large that it makes us lie awake at night thinking how in the name of heaven we are going to get them; and the only way that we will be able to get them when we want them is by means of the merchant marine. In that body of men we find the very material that we need, men who with a few weeks of naval training will make first-class sailormen. Of course, we shall not be able to throw them right into the best positions in the ships, will not be able to give them the most responsible positions, but for those positions the men whom we are laboring with every day, whom we are teaching, who are looking so straight through the sights of their guns at the present time, will be the men that we shall assign to them. The others will have to do the lower grade of work.

I think there is another point of view from which you all might look at the need for merchant marine, and that is that we are paying out immense volumes of money to carry our product abroad. Why should we not have the money in this country? Why should not our own people be getting the benefit of it? Why should it go abroad? It may be that we are fostering the very men who are going to fight us in a few years. Nobody can tell. No one knows when war may come. God knows none of us want it. I do not think that any man here among you who has ever seen war, will ever want another one, if you can get out of it with honor to your country. I never saw a man who had seen the slightest bit of war who would ever vote to have another one if he could avoid it.

Then, think of the importance of building the ships in this country. Look at the ramifications that you go through to get the product, a ship. The metal from the ground even, the miners, the smelters, all the people through whose hands it goes, the rolling mills, all the laboring men; see the amount of money that is spent in building a ship! When we have none built, the money is not spent here, and the profits go somewhere else. But to give you just a slight idea of the amount of money that is used up in building ships and taking care of them, I may mention that our little navy yard over in Brooklyn, of which I have the honor at present to be in charge, last year spent $5,600,000 in wages alone. That sounds like a large sum and it is, and you have got to work for it, too. The times have arrived in our navy, and in our government at large, where you get the worth of the money that you pay out. The political grafter has gone out of the navy yards, and if anything is not done properly, it is the naval officers whom you must hold to account, and I assure you that they are very anxious to have the accounts square.

So, I would ask you all please to bear in mind, and remember beside, what the secretary of war has told you, and use your influence for the building up of our poor little navy, and see if you cannot use your influence to have congress so arrange that we may have the greatest need of the navy at present, and that is a merchant marine from which we can draw, should war unfortunately come upon us.

BIDS FOR BATTLESHIPS.

The Cramps of Philadelphia were the lowest bidder for the ships of the Michigan and South Carolina type with the machinery as prescribed by the navy department. The department plans for machinery will probably be accepted by the navy department in preference to plans of bidders, as submitted in other proposals.

The bids for the prescribed machinery were known as Class 1 bids, and the Cramps offered to build a ship of this type for $3,540,000. The New York Ship Building Co. offered the next bid in this class, $3,585,000. The Newport News Co.'s bid was $3,673,000, and the Union Iron Works' was $4,250,000. As one firm is allowed to build only one of the ships the second bid will doubtless be accepted in case the department decides to accept the Class 1 plans.

In Class 2 there was a great variety of bids, and the prices varied according to the plans of the various ship yards for machinery. Under this class the machinery may be of turbine type, and many of the bids specified turbine engines.

The lowest offer in this class was that of the Fore River Ship Building Co. for $3,689,000, for a turbine vessel. The various offers were:

New York Ship Building Co., with turbine engines, $3,900,000 and $3,850,000.

Newport News Ship Building & Dry Dock Co. $3,945,000, $3,813,000, $3,963,000, $3,753,000 and $3,713,000. The last three bids provided for turbines.

Fore River Ship Building Co., turbines, $3,945,000, $3,820,000, $3,719,000, $3,780,000, $3,689,000.

William Cramp & Sons Ship & Engine Co., $4,100,000.

The great variety in these bids is due to the difference in plans. The new battleships are to be 450 ft. long, and will have an extreme breadth at the water line of 80 ft. 2⅝ in. The mean draught at trial displacement is not to exceed 24 ft. 6 in. The coal bunker capacity of the ships will be 2,200 tons each. Each ship will have a main battery of eight 12-in. breech-loading rifles and two submerged torpedo tubes. The secondary battery will consist of twenty-two 3-in. (14-pounder) rapid-fire guns, two 3-pounder semi-automatic guns, eight 1-pounder semi-automatic guns, two 3-in. field pieces, and four machine guns of calibre .30. The 12-in. guns will be installed in pairs, in four electrically controlled, balanced elliptical turrets, on the center line, two forward and two aft, each with an arc of fire of about 270 degrees. The vessels will be driven by engines of 16,500 H. P.

The senate amendment to the big 20,000-ton battleship item in the naval appropriation bill was adopted by the house after a vigorous fight. The amendment provides that before any proposals are received and accepted the secretary of the navy shall report to congress at its next session full details covering the type of such battleship. There was some objection to this on the ground that foreign navies could gain complete information of the ship, but it was held that they would get it anyhow.

THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

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JUNE 28, 1906.

SHIP BUILDING ON THE LAKES.

During the year 1903 the ship yards of the great lakes had under order sixty-two vessels of which forty-eight were bulk freighters, capable of carrying in a single trip 230,950 gross tons of ore. During 1904 they had under order forty-seven ships of which twenty-two were bulk freighters, having a carrying capacity on a single trip of 214,200 gross tons of ore, thus showing that in that single year the average carrying capacity of ships had nearly doubled. The orders placed with the ship yards during 1905 for 1906 delivery included thirty-nine vessels of which thirty-four are bulk freighters having a carrying capacity in a single trip of 338,000 tons. The present program for 1907 delivery includes fourteen bulk freighters and one passenger boat and more orders are pending. The revolution in ship building on the lakes since the Augustus B. Wolvin was launched in April, 1904, has been astounding. Nearly all the vessels mentioned in the list are giant carriers, meaning by that from 8,500 to 13,000 tons, with the average about 10,000 tons. The fleet of 10,000-ton ships has really become so numerous as to excite no comment. But there are not many ships on the ocean larger than the largest on the lakes. Moreover, the trade in which these ships engage is assured for many years to come.

LEVEL OF THE LAKES.

A meeting of extraordinary importance to vessel owners is now under way at Buffalo. A delegation from Chicago is appearing before the International Waterways Commission for the purpose of obtaining authority to divert 14,000 cu. ft. more of water per second from Lake Michigan for the purpose of flushing its sewage through the drainage canal. The present quantity, which is diverted for this purpose, is 4,167 cu. ft. per second, but Mr. Isham Randolph, chief engineer of the sanitary district of Chicago, maintains that it is not sufficient. The chief concern of the vessel owners is as to the effect that such diversion would have upon the level of the lakes. Representation was made that 14,000 cu. ft. more per second would lower Lake Erie 7 in. and the other lakes about 8 in. As the modern carrier carries about 100 tons on an inch of water, 8 in. would mean a loss of 800 tons in carrying power on each trip, or 16,000 tons in an average season. Resolved into dollars at 75 cents per ton, it would mean a loss of $12,000 per vessel in gross receipts. President Wm. Livingstone and Mr. Harvey D. Goulder, counsel, are representing the Lake Carriers' Association at the meeting. Mr. Francis King of Ottawa, is representing the Dominion Marine Association. The sessions will probably last for several days.

THE SHIPPING BILL.

Officers of the Merchant Marine League visited Washington this week to obtain a definite statement from Speaker Cannon concerning the status of the shipping bill. The definite statement was made that the bill could not pass during the present session. Thus one man defeats, for the time being, the express desire of the commercial interests of the country. The campaign waged for the shipping bill by the Merchant Marine League has been the most energetic and the most intelligent ever conducted in this country for a bill. The public conscience has been quickened to a greater degree than ever before to the deplorable conditions existing in our over-sea trade and scores upon scores of commercial organizations have protested against it. Bankers, manufacturers and business men through their boards of trade and other organizations have petitioned congress to remedy the handicap under which American shipping in the foreign trade is now operating. The arguments which have been presented are convincing. Every congressman is now familiar with them. Moreover there is no doubt but that a majority of the members of the house of representatives would vote for the bill if permitted to exercise their powers. There is hope that the bill will be speedily presented at the next session of the present congress. To this end the Merchant Marine League will now bend its energies.

IMPROVEMENT OF WATERWAYS.

Four hundred business men, members of the Chamber of Commerce and Merchants and Manufacturers Association of Greater Pittsburg, gathered at the Hotel Annex, Pittsburg, on Tuesday evening of this week and expressed themselves in no uncertain terms as favoring larger congressional appropriations for river and harbor improvements. In a ringing speech Congressman Jos. E. Ransdell of Louisiana, chairman of the executive committee

H. D. W. English, president of the Pittsburg Chamber of Commerce, was chairman of the meeting and F. R. Babcock, president of the Merchants and Manufacturers Association, toastmaster. Harvey D. Goulder, of Cleveland, and Congressman J. Adam Bede, who were to speak were detained at Washington and were not present.

IRON ORE MOVEMENT.

The movement of ore up to June 1, 1905 was 10,814,-054 tons. The movement during June of last year was 4,999,-350 tons. The movement up to June 1 of the present year was 5,752,342 tons. The movement during the present month is expected to reach 5,500,000 tons, so that the movement up to July 1, 1906, will be about 11,250,000 tons or half a million tons greater than the corresponding movement for last year. The set-back, therefore, of the earlier months of this season, has been overcome. The banner month last year was July when 5,224,620 tons were moved. It is expected that the flow of ore during July of this year will be over 6,000,000 tons and there is no doubt whatever, unless unforeseen conditions arise, that the vessels will readily handle it. Ore is being rushed forward at a rapid rate and little delay has been experienced all along the line, as weather has been favorable and shipments from mines have been much better since the rains have ceased. To handle 6,000,000 tons of ore in a single month, however, means that the mines ... 200,000 tons a day. In fact, if the total

... past fifteen years.

Mr. Joseph Berholzheim, general manager of the Manitou Steamship Co., Chicago, has just issued a hanger descriptive of their service between Chicago and Mackinac island. It is illustrated with a fine lithograph of the steamship Manitou, and also a map of the route traversed by the steamers of the fleet.

The new steamer Brittania, of the Detroit, Belle Isle & Windsor Ferry Co., will go into commission about July 1 and will entail the following changes in the personnel of the fleet: Capt. Robert E. Ferguson, of the Pleasure, will sail the Brittania; Capt. John Denstead, now on the Sappho, will sail the Pleasure; Capt. Archie Baines, of the Excelsior, will sail the Sappho and Capt. Wm. Ferby will sail the Excelsior; Hugh McAlpine, who has been chief engineer of the Pleasure will become chief engineer of the Brittania.

WATERWAY FROM LOCKPORT TO ST. LOUIS.

The river and harbor act of 1902 appropriated $200,000 for an investigation of a 14-ft. navigable waterway from Lockport to St. Louis, and a similar waterway 7 and 8 ft. deep from La Salle to Ottawa. The Mississipp River Commission was charged with the investigations from the mouth of the Illinois river to St. Louis, while the remainder of the work was in charge of a board of officers of the corps of engineers, of which Col. O. H. Ernst was chairman. The report of this investigation has just been published, and contains a great deal of

four existing dams

This work is estimated to cost about $23,500,000, using concrete locks 600 ft. long, 80 ft. wide and 14 ft. deep on the sills. The cost of the 7-ft. and 8-ft. waterway from La Salle to Ottawa is estimated at $928,000 and $961,000, using locks 350 ft. long and 75 ft. wide. The Mississippi river improvements include a movable dam at Alton, a lateral canal from Alton to St. Louis Harbor and a lock 600 ft. long, 80 ft. wide and 30 ft. in lift. These works are estimated at $6,554,000. No opinion concerning the advisability of undertaking the project is expressed in the report, as it is not called for in the act ordering the survey.

RENTAL OF PIERS.

The Commissioners of the Sinking Fund of New York last week accepted a committee report on the rental of the piers included in the Chelsea improvement area, with formal thanks to the non-official members—President Norman of the Maritime Association and A. Foster Higgins of the Chamber of Commerce. The report adopted recommended leasing the five northerly piers to the International Mercantile Marine, the three southerly piers to the Cunard Steamship Co., and the remaining pier, No. 57, to the Compagnie Generale Transatlantique. The city is to erect the necessary sheds and to do the dredging to maintain the proper depth of water. The companies are to do all necessary repairs. The term of lease is to be ten years, with the privilege of two renewals of ten years each at an advance of 10 per cent over the previous term. The rental for the first term of the lease is to be $70,000 per annum for each pier with two sides available for wharfage.

speech in behalf of the Chamber of Commerce, in which he said that for the first time in forty years the city had acted with "justice and generosity" in dealing with outside interests.

BATTLESHIP AGAMEMNON LAUNCHED.

The British battleship Agamemnon, of 16,500 tons, was successfully launched at Glasgow, and was christened by the Countess of Aberdeen. Among the novelties in the construction of the ship are the following: All her guns will be above the upper deck and her heavy guns will be more concentrated in the center of the vessel, while the smaller pieces will be carried on a central platform deck, extending about one-third the length of the ship and upwards of 30 ft. above the water line, giving great command on all sides of the water around the ship. The Agamemnon is 410 ft. long, has 79½ ft. beam, draws 27 ft. of water, and her engines have 16,750 I. H. P., giving her a speed of 18 knots. She has an armored belt 12 in. thick and has 8 in. of armor on her sides, above the belt. Her armament consists of four 12 in. guns, ten

9.2 in. guns, thirty-seven smaller guns, and five torpedo tubes. The new battleship carries 900 tons of coal and a crew of 865 officers and men. She will have cost about $7,500,000 when completed.

INTERCOASTAL CANAL.

New Orleans, La., June 25, 1906:—The movement for an intercoastal canal to connect Donaldsonville, on the Mississippi river, with the mouth of the Rio Grande, was launched at a big meeting of delegates from the various sections interested which was held at Lake Charles, La., several days ago. The convention endorsed the project and organized an association to take the fight before the national congress in an effort to secure an appropriation for the work. The canal in contemplation will be something like 700 miles in length and about 60 feet in width. Committees were named to agitate the matter, collect the

[illegible]

all the necessary data which will be needed in the campaign it is purposed to make in favor of the canal. The estimated cost of such a canal will be in the neighborhood of $8,000,000.

Among those who participated in the business transacted by the convention were Hon. Jared Y. Sanders, lieutenant governor of Louisiana; Congressman J. E. Ransdell, A. P. Pujo and R. F. Broussard, of Louisiana; Congressman Walter Gresham of Texas, State Senator A. B. Davidson of Cuero, Texas, and a goodly number of other prominent men from both states.

Before adjourning the convention named a committee from each state interested and organized a permanent association to carry on the work in hand. The officers of the association are: C. S. E. Holland, Victoria, Tex., president; H. L. Gueydan, Gueydan, La., first vice president; R. A. Cowert, Dallas, Tex., second vice-president.

These are the men from both states named on the committee:

Louisiana—Leon Locke, Lake Charles; E. A. Pharr, St. Mary; S. Locke Breaux, New Orleans; Walter J. Burke, New Iberia; E. P. Munson, Napoleonville and C. C. Duson, Crowley.

Texas—C. A. Summers, Cuero; Walter Q. Gresham, Galveston; J. B. Baker, Waco; Hugh S. Jackson, Beaumont; G. J. Palmer, Houston; Royal A. Givens, Corpus Christi.

IMMIGRATION PROBLEM AT NEW ORLEANS.

New Orleans, June 25, 1906:—After months of delay the immigration station problem at New Orleans has at last assumed definite shape and there is a probability that within a very short time the board of port commissioners will be in a position to build the station. In fact, arrangements have already been made whereby the commission will build the station provided it is given the authority by

[illegible]

will in all probability meet with no opposition at all. A conference between Col. Schuler, the state commissioner of immigration and agriculture and the dock board was responsible for the step taken by the dock board in the matter and now all that remains to be done is for the board to secure the necessary authority from the general assembly of the state. This, it is believed, will not be hard to secure. The station will cost in the neighborhood of $15,000.

In connection with this same matter it might be mentioned that Wisner & Dressner of this city have offered to build the station at a cost of $15,000 provided it is given the exclusive advertising privileges inside the station. The reason for making the offer, it was stated, was because the firm was deeply interested in the reclamation of swamp and wet prairie land about New Orleans and very desirous of getting in touch with the agricultural element which would be represented in the immigration attracted.

AROUND THE GREAT LAKES

The steamer Gladstone was released from Pilot island without injury.

Traffic in the Lachine canal was blocked by a sunken barge for two days last week.

Mr. Guy C. Kemp has been appointed agent of the Anchor line at Sault Ste. Marie, vice S. H. Davis deceased.

The steamer Scottish Hero, a British built boat which was towed through the Welland canal in two sections, will be put together at Buffalo.

The steamer Charles Weston, of the Tonawanda Transit

of the Great Lakes Engineering Works for J. W. Ellsworth & Co., of Cleveland, underwent her successful trial on Saturday last and has since been delivered to her owners.

Capt. C. H. Sinclair, underwriter representative, has disposed of the coal cargo of the schooner Hattie Wells to J. W. Thompson, of Port Huron. The Wells which was damaged in a blow on Lake Erie will be repaired at Port Huron.

H. J. Pauly, of Milwaukee, is considering bids from various wrecking companies for the raising of the steamer John Duncan on the bottom of Northport harbor. The wrecked steamer is in no danger of further damage and in its present position does not interfere with traffic.

Extensive improvements at Harbor Beach, Mich. are recommended by Secretary Taft in a communication to congress. These include dredging the harbor and constructing a breakwater at a total proposed expense of $970,000. The recommendation is based upon the reports made by Major Lansing H. Beach and Capt. Charles Kellar.

Difficulties which have been met with in the construction of the second canal at St. Clair flats were made last week the subject of an inquiry from Washington to Col. Davis, United States government engineer in charge of the improvements. Col. Davis says that the matter is not serious. Two breaks have occurred in the work but will be remedied by new piling.

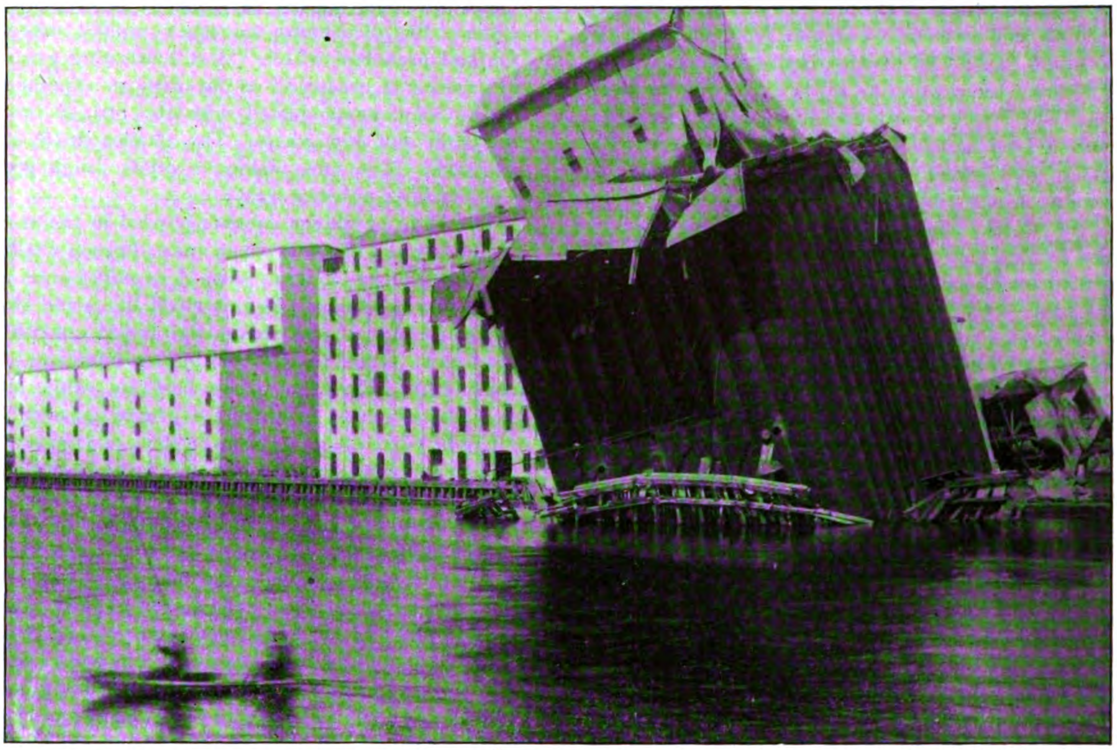
Mr. Joseph W. Ripley, general superintendent of locks on the Sault Ste. Marie canal, has been appointed a special engineer for work in designing and construction of the locks in the Panama canal. Mr. Ripley has been in Washington for some time past in consultation with Chief Engineer Stevens and sailed with the Panama commission

23 just inside the breakwater of the Pennsylvania dock, Cleveland, has been raised and repaired. She left for Port Huron this week. This steamer left Cleveland harbor May 23 loaded with coal. She sprang a leak shortly after leaving harbor and though Capt. Sewell Moore put back to port with all possible speed she sank just as she reached the breakwater.

The steamer Steel King which was in collision with the steamer Manchester and which was on the bottom at Harbor Beach, is in dry dock at Buffalo. Favorable comment is made over the display of good judgment by Capt. Delaney, of the steamer Steel King. After the collision with the Manchester the Steel King took in water rapidly and was drawing 21 ft. with a list of four feet when she settled in shallow water in Harbor Beach. The saving of the steamer was due to Capt. Delaney's promptitude in getting tarpaulin around the hole in the steamer's hull and his quick run into shallow water.

OGILVIE ELEVATOR ACCIDENT.

The condition of the Ogilvie elevator at Fort William which started to slide into the bay on the night of May 26, is about the same and work is still going on in an effort to save the contents, which at the time of the collapse amounted to 360,000 bus. of wheat, 60,000 bus. of oats and 1,000 bus. of barley. It is claimed that all of this but about five or ten per cent will be saved because the bins are still practically intact. The ruin of the building was most peculiar. It has stood strong tests for two years, having held most of the time about 500,000 bus. of grain and was practically new. On the night of May 26 it suddenly started to slide into the bay and moved about 25 ft. It is now stationary at an angle of about 20 degrees as shown in the accompanying pictures. Luckily only one or two people were about and nobody was hurt. The collapse, it is believed, was caused by the displacement of the pile foundation. The working part of the house on top of the steel tanks collapsed completely. The elevator, even though the steel tanks are still holding together, is practically a complete loss. It has never been fully taken over from the contractor, the MacDonald Engineering Co., of Chicago, who is under bonds to the Ogilvie company for a large amount. The elevator is of steel on the usual concrete foundation.



SHOWING THE SLIDING OF THE ELEVATOR INTO THE HARBOR.

The steamer Blanca was launched last week from the yard of John H. Dialogue & Son. This vessel has been built to the order of Pim, Forwood & Kellock, of New York for account of the railway and navigation department of the Nicaraguan government and for use in the harbor of San Juan del Norte, commonly known as Greytown, Nicaragua. The Blanca is a twin-screw steamer of steel construction.

Capt. Wm. E. Hoy, of the tug Record, has been suspended for fifteen days on account of collision between the steamer Merida and schooner Antrim. The inspectors found that the signals were properly given and understood, but that the Record failed to follow the course that it should have taken.

AT THE HEAD OF THE LAKES.

Duluth, June 25.—The movement of ore boats at this end of the lake is very much better. The Missabe docks alone delivered during the past week in the neighborhood of 425,000 tons. At the week's end especially a large fleet of boats were handled. The same conditions hold true at Allouez and Two Harbors and though there are many to be found who are deprecating the predictions of 38,000,000 tons shipments on the basis of relative tonnages handled this year and last, ore interests, aside from the set-back due to the weather of the past week, are gratified at the situation.

The handling of grain is seasonably dull, the following being the receipts and shipments at the upper end of the lake for seven days ending June 23.

	Receipts.	Shipments.
Wheat	168,254	251,757
Oats	148,218	1,247,009
Barley	18,079	34,161
Rye	746	....
Flaxseed	158,469	275,990

The barge Antrim which was in collision last week in the bay at this port and which was repaired here was towed over to the Missabe dock this morning to load ore. The Hoover & Mason which grounded in Ashtabula harbor on the last trip down injuring several plates is to be repaired here before starting on another trip.

A revised edition in colors of coast chart No. 4, Lake Erie from Conneaut to Chagrin river, has just been issued by the United States Lake Survey and is for sale by the MARINE REVIEW.

The battleship New Hampshire will be launched at the yard of the New York Ship Building Co., Camden, N. J., on Saturday, June 30. Miss Hazel E. McLane, Concord, N. H., will be sponsor.

The steamer B. F. Jones has been successfully unloaded at the Angeline dock at Ashtabula. The Jones is 550 ft. long and is the largest vessel that has ever visited Ashtabula.

GREASE VERSUS OIL.

The question of lubrication is an all important one to every owner or operator of machinery. Oil is most extensively used as a lubricant, notwithstanding its ability for shirking its work. As soon as the shaft begins to revolve, the oil is ready to escape, and soon finds its resting place. Oil is not only ready to leave the bearings quickly, but is ever ready to fly off by centrifugal force, covering the walls, ceilings, floors and stock with its oily seft, increasing fire risk as well as damaging large quantities of stock. Oil on bearings wastes away very rapidly and without a constant feed, the bearings become dry, which results in overheating, excessive friction and liability of fire. Lubrication by oil is expensive for mills and factories. The waste of oil and the constant attention required, totals a large amount at the end of the year. We might also take into acount the losses by friction and uncalled for repairs, which amount far exceeds the cost of oil.

The late Prof. R. H. Thurston estimated the average loss in mill friction at 50 per cent. This being the case, how much power is used to overcome the friction on shafting which is oiled perhaps once every day and in some cases where the shafting is only oiled once in every two or three days? Friction goes on between the unlubricated shaft and bearings and varies with the pressure, doubles the pressure, doubles the friction and so on until the bearings become so hot that they take fire. Friction also causes wear and tear, a part of which is unavoidable, but preventable friction is negligence, ignorance or bad judgment. Oil lubrication must have constant attention if the owner or operator of machinery wishes to reduce friction to a minimum. The oil should be fed in uniform, adequate quantities, just sufficient oil to make friction as little as possible. The only successful method of oil lubrication is by oil baths, and automatic feeding. By this means the bearings are constantly flooded. Oil must also be adapted to the particular bearing on which it is to be used.

The least possible friction is maintained when the oil has sufficient body to keep the journals and bearings apart; we then have fluid friction. But, if the oil is weak, it soon wears out and we then have, to a great extent, solid friction and necessarily increased power to overcome it. Some parts of machinery may be worked with almost any kind of oil, while other parts can scarcely be worked without a lubricant adapted to that particular part of the machinery. Manufacturers of oil have taken these facts into consideration and make from twenty-five to thirty different grades of oil. One of the grades suits the requirements of a certain machine or of parts of it.

The supply man looks on the subject in a different light. He does not say to the purchaser that a certain kind of bearing requires a certain grade of oil. His chief object when introducing oil is the price and to see that his price is below that of his competitor; his aim is to sell oil. A barrel of oil made up of three or four different grades which is expected to do the work, and, their oils are as good as can be expected under the circumstances.

The user of oil generally looks on the price of oil by the gallon, he does not take into consideration the different grades, or their ability to reduce friction to a minimum,—so long as the machinery is kept moving, with an occasional hot bearing or flooding of oil, no attention is paid to the amount lost by preventable friction. Some operators forget internal friction, the bearings do not take fire, but the friction is there all the same, possibly within a few degrees of shutting down the entire plant. Should a hot bearing be discovered, the first thought is to pour on oil with no consideration of the enormous amount of wear and tear and loss of power.

Some years ago oil was deemed to a certain extent, unsatisfactory as a lubricant. Then the supply houses began to look around for something to take its place. They found that a grease could be procured by taking a by-product of petroleum and with the addition of resin, resinous oils, tallow, graphite, talc or beeswax to this substance, they could give in part the much desired results. This product was put on the market at a small cost and a large profit to the manufacturer, the user being left to decide as to its merits.

The oil user took to this method of lubrication gladly, thinking the problem of lubrication was solved at last. He, however, soon found the journals of his machines heating more than ever. The shafts and boxes became sticky and black, the wear almost as great as before, and, to cap the climax, the oleaginous substance rapidly melted, following the bad precedent of oil. Most lubricating greases are made by treating a grease oil of fat with an alkaline body, which makes soap, amalgamated with the rest of the oil, making the latter stiff and greasy. The alkalies chiefly used are lime and soda. The lime making a crude rough grease and the soda making a better grade.

The body or fillings commonly used in the manufacture of grease are powdered gypsum, mica, French chalk, black lead, etc. Gypsum or mineral white does not contain any lubricating power whatever. French chalk has some slight lubricating properties, it also makes the grease smooth and soft to the touch. Graphite is a well known lubricant. Some of the above add to the value of the lubricant, while others do not, and are only used to make the grease apparently stiffer.

Crude resin oil is a cheap product and is very extensively used for making grease. The oil cannot be considered a good lubricant, having an acid character; being viscous it has a corrosive action on metal. The flash point of resin oil makes it very undesirable for use in mills and factories. Resin oil is often mixed with lime for making grease. Resin in oil can be detected by subjecting the oil to heat. Acid in grease can be detected by bringing it into contact with brass for about twelve hours, when the brass will have acquired a green tint, showing that it has dissolved some of the metal.

Anthracite oil mixed with lime makes a cheap but undesirable grease. It is probably the cheapest of all greases or grease stock. It smells strongly of tar oils and is much used to make the cheaper qualities of grease. Grease is also made from the residue in the retorts after the lighter oils, the lubricating oils and the paraffine wax have been extracted.

It will be plainly seen by the above that grease manufactured for the supply houses will not give the desired satisfaction as a lubricant. The cheapest kinds of materials possessing the least lubricating properties are compounded in it because they are the best mediums of profit and it gives the operator no end of trouble. Little or no attention being paid to the manufacture of the so-called grease, manufacturers never thought of making a grease with a natural body, consequently put out on the market a grease made up of hurtful ingredients, which do not flow freely over the shaft, which corrode the bearings and cause excessive friction. Grease made up after the above formula will deteriorate by climatic changes, hence the necessity of making a hot and cold-weather grease.

Some years ago the Keystone Lubricating Co., of Philadelphia, took up the subject of grease lubrication and they have been successful in producing a lubricant which gives greater satisfaction than oil or any other grease that is placed on the market today. It is cheaper because it is more durable, has no injurious fillings, is free from corrosive action and requires less attention than any other kind of lubricant. A chemical analysis of this lubricant has been made by such experts as the late Prof. R. H. Thurston, Cornell University; Prof. R. Schmelk, Christiania, Norway; Dr. J. E. Alen, Gottenburg, Sweden; and Mr. Julius Williams, consulting chemist, Hamilton, Ont., all of whom show that no resin, resinous oils, mineral acids, fat acids, mineral matter, such as clay, grit, graphite or any volatile matters such as naphtha, ben-

zine, or any substances detrimental to machinery enter into its construction.

It will not be affected by prolonged boiling in water and will therefore be permanent in bearings liable to be steamed. It has a high melting point and does not carbonize at a very high temperature and after being heated for some time at an extremely high temperature, it still retains its lubricating qualities. Heat and cold do not affect it and it does not become rancid when exposed to atmospheric changes.

In a comparative test with three high-class oils and Keystone grease, the average coefficient was in favor of the grease as follows:

In percentage 11.2 per cent 14.8 per cent 3.53 per cent.
The minimum amount of friction for oil, 31 lbs. 28.5 lbs. 24.5 lbs.
The minimum amount of friction for grease, 21.5 lbs. 22.5 lbs.
The rise in temperature No. 1 oil 1° Fahr. in 17.3 revolutions.
The rise in temperature No. 2 oil 1° Fahr. in 25 revolutions.
The rise in temperature No. 3 oil 1° Fahr. in 20 revolutions.
The rise in temperature Keystone grease 1° Fahr. in 141.6 rev.

The above shows that Keystone grease is not compounded after the old formula, but is a new departure and founded on natural requirements. In comparison with oil, the test is by far in favor of the grease, the coefficient of friction being much lower. This proves that a large saving in power is accomplished and repairs and repair bills reduced to a minimum. The durability of Keystone grease far exceeds oil, making it the cheapest, cleanest and most desirable lubricant known.

This lubricating grease is now used in every part of the known world. It is used on all kinds of machinery, stationary engines, locomotives, steamships, passenger coaches, freight cars, refrigerating, electrical, agricultural, woodworking and textile machinery. Keystone grease is made in densities to suit the different classes of machinery. It is furnished in a light body suitable for use upon light knitting machinery or in one with sufficient body to stand the pressure a crushing machine will place on it. Its ability to reduce friction and minimize wear makes it an ideal lubricant. One pound will outlast four to six gallons of oil. It will not leave a gum or sediment, neither will it melt or waste away.

STEEL CONSTRUCTION FOR STEAMBOAT SUPERSTRUCTURES.

(From *The Iron Trade Review.*)

For a number of years past our esteemed contemporary, *The Engineering News* has been calling attention to the flimsily constructed and highly inflammable superstructures of the river and harbor boats of the country, with particular reference to those plying on the Hudson river and Long Island Sound. The recent burning of the steamer Plymouth of the Fall River line at her dock has been the subject of another editorial by our contemporary. It takes a stand that all steamboats used for passenger traffic should not only be constructed with steel hulls, but with fireproof superstructures, or at least superstructures, which will burn less readily and be provided with better means for the extinguishment of any fire which may occur than are those at present.

In this contention, our contemporary is entirely right. The awful consequences which attend a fire upon a crowded passenger steamer were illustrated in the case of the General Slocum, which burned in New York harbor with a loss of life of over 1,000. This occurred within a short distance of shore and within easy reach of what are probably the finest harbor fire fighting appliances in the world. Yet, so rapid was the destruction of the upper portion of the vessel that before any aid could be given her, she was burned to the water's edge with appalling loss of life. The burning of the Plymouth fortunately occurred when there were few people on board, and these few were employes, all more or less familiar with the boat. Yet, so rapid was the spread of the fire that one of these men, who probably knew his way about the ship, and who had only himself to take care of, was not able to escape. Had this fire occurred at night in the middle of Long Island Sound, when the vessel was loaded with sleeping passengers, the consequences would have been too horrible to contemplate.

It does not seem, at first glance, an impossible or even difficult problem to render these boats more safe. The superstructures are, at present, almost entirely of wood construction. In these days of economical production of iron and steel, it seems almost criminal that so dangerous a material as wood should be employed in such a place. Steel columns, girders and floor beams could, undoubtedly, be employed in place of wood, and metal sheathing is no experiment. It might be contended that the decorative effects contained in the interior of these boats are impossible without the use of wood, but is it worth while to sacrifice hundreds of lives, from time to time, for the sake, more or less, of glaring ornamentation? Nor are we ready to admit that wood is absolutely necessary for this purpose. Expanded metal and plaster partitions might be employed and handsomely decorated and stamped metal ceilings could be made to give almost, if not quite as artistic an effect as highly carved wood. While there may be engineering difficulties in the way of substituting steel for wood in these boats, we do not believe that they are insuperable. There is, undoubtedly, a field for the extensive use of steel if the matter is only properly taken up.

ENGINEERING ITEMS FROM BRITAIN.

The death has taken place at Edinburgh of Mr. Andrew Betts Brown, head of the firm of Brown Bros. & Co., Ltd., and a well-known inventor in matters relating to marine engineering. He was the inventor of the steam and hydraulic reversing engine, but his greatest achievement was the telemotor and steam tiller, with which practically every steamship is fitted. The firm of which he was the founder has been entrusted with many important contracts by the British admiralty and foreign governments.

A great movement is on foot in Britain to establish at Scotstoun, Glasgow, a large ordnance works and a dock. The firms interested in the combination are those great building, ordnance and armor plate concerns which came to an understanding some little time since with the object of improving the conditions all around, and increasing the facilities of output. These companies are Messrs. Cammell Laird & Co., Birkenhead and Sheffield; Messrs. John Brown & Co., Clydebank; and the Fairfield Ship Building & Engineering Co., Ltd., of Govan. The works contemplated at Glasgow are intended for the manufacture of ordnance and machinery and fitting same on board the warships for which they are intended. The site selected covers an area of some 20 acres.

Mr. Charles M. Holder died at his late residence in Brooklyn, N. Y., on May 26, at the age of eighty-five years. He had been engaged all his life in spar making and ship repairing at New York, under the firm name of Holder & Smith. The firm retired from active business several years ago.

Capt. John Johnston died at Detroit at the age of seventy-three years. He retired about fifteen years ago, having sailed the lakes at that time for about thirty-five years in the employ of the late A. Chesebrough and C. C. Blodgett.

The James Reilly Repair & Supply Co. have just moved into their new building in New York, a handsome seven-story light brick structure, which will give them much greater facilities for handling their extended business.

SCIENTIFIC LAKE NAVIGATION

By Clarence E. Long

THE MARINER'S COMPASS.

LESSON II.—*Continued.*

There are four cardinal points on the compass card—north, represented by N.; south, S.; east, E.; and west, W. East being to the right, and west to the left, the observer facing the north. The north-and-south line of the compass is called the meridian of the compass, and may be regarded as coinciding with the meridian on which the vessel is located, and from it all sailing courses are reckoned, as will be hereafter explained. All the points of the compass are called by names composed of these four cardinal points. Half way between each pair of cardinal points will be found an intercardinal point, called after the adjacent cardinal points; hence the point mid-way between the north and east, is called northeast, and represented by NE; so mid-way between south and east is called southeast, and written SE; in like manner we get southwest, written SW, and northwest, written NW.*

A point half way between one of these intercardinal and cardinal points is called in like manner, by a name composed of the nearest cardinal point and the adjacent points, NE, NW, SE and SW. Thus, the point half way between N and NE is called north-northeast, written NNE; the point between E and NE, is called east-northeast, written ENE; and so we have ESE, SSE, SSW, WSW, WNW and NNW.

The points next to the eight principal points (the points marked, or lettered, on the card), namely, N, NE, E, SE, S, SW, W, and NW, are named by placing *by* (denoting by or next to) between the letter representing the point to which it is adjacent, or nearest to, and the next cardinal point in the same direction. Thus, the point next to N, on the east, or right side, is called north by east, that is, north in direction towards east, written N by E; that next NE towards the north, is called northeast by north, written NE by N, that is, NE in direction towards north, and so we have NE by E, E by N, E by S, SE by E, SE by S, S by E, S by W, SW by S, SW by W, W by S, W by N, NW by W, NW by N, and N by W—16 in all; 4 cardinal and 4 inter-cardinal makes 24 and with the 8 points lying midway between the cardinal and inter-cardinal points, known as the 2 and 6-point courses, completes the list of the 32 full points. We have now got names to all the thirty-two points of the compass, and the reason for them being so named. Bear this in mind. The cardinal and inter-cardinal points, are always marked on the card by letters in an abbreviated form, except at the north point, which has a distinguishing mark called a fleur-de-lis, which originated with the ancients.

Each cardinal point is 8 points away from the next cardinal point, and 4 points from the next, or nearest, inter-cardinal point.

The names of the whole points are as follows:

North, north by east, north-northeast, northeast by north, northeast—5.

Northeast by east, east-northeast, east by north, east—4.

East by south, east-southeast, southeast by east, southeast—4.

Southeast by south, south-southeast, south by east, south—4.

South by west, south-southwest, southwest by south, southwest—4.

Southwest by west, west-southwest, west by south, west—4.

West by north, west-northwest, northwest by west, northwest—4.

Northwest by north, north-northwest, north by west—3.

$5 + 4 + 4 + 4 + 4 + 4 + 4 + 3 = 32.$

Here they are again in their contracted form, this being the manner in which they are written and employed in practical navigation.

N, N by E, NNE, NE by N, NE, NE by E, ENE, E by N, E, E by S, ESE, SE by E, SE, SE by S, SSE, S by E, S, S by W, SSW, SW by S, SW, SW by W, WSW, W by S, W, W by N, WNW, NW by W, NW, NW by N, NNW, N by W—32 in all.

The system of notation of the compass in points is called western, and rests on the wind and sun. The Arabs gave their floating compass this notation in the thirteenth century. The notation called eastern is the Chinese twenty-four points, or the old astrological division of the horizon into twelve double hours. The Chinese used the compass for telling time as well as for pointing out the directions of the horizon.

The student should thoroughly commit to memory the names of the whole points of the compass, as given above, so as to be able to repeat them unhesitatingly, and in their regular order—from north, back to north by way of east, south and west. Until the student is master of the compass points and their relations, as well as the principle upon which they are named, he should go no further. When he has learned these he must then acquaint himself with the half and quarter points of the compass card, as set forth in the table of compass angles, given on another page, and which should be carefully and zealously studied.

Each point, is sub-divided into half and quarter points. The novice on board ship would not think that a quarter of a point in the course would make much difference, but if you were endeavoring to sail from one port to another 200 miles north of it, and steered a quarter of a point east of north, you would arrive at a place 10 miles, nearly, east of the spot you were aiming at. Again, if you were trying to cross the ocean, and steered a quarter of a point wrong, you would be from 100 to 150 miles out of your course. The names of the half and quarter points are formed from the whole points to which they are nearest.

A half point, which is the middle division between two whole points, is called after that one of its adjacent points which is either a cardinal point, or is the nearest to a cardinal point. Thus, the middle division between

*These new directions also give names to the four quarters, or as they are called quadrants of a circle, or of the horizon, as, when we say that "the wind is in the NW quarter," meaning thereby not exactly NW, but somewhere between N and W. These quarters, or quadrants, are again named first, second, third, and fourth quadrants; thus, from N to E is called the first quadrant; S to E, the second quadrant; S to W, the third quadrant and from N to W the fourth quadrant.

N and N by E is called north-half-east, written N½E. Half points near NE, NW, SE and SW, take their name from these points. Thus we say NE½N, NE by E½E.

The same holds for a quarter and for three-quarters as for a half point, all of which are named upon the same principle as the subordinate points.

The average marine man and vessel captain imagines that being capable of boxing the compass according to the full points, there is little or nothing more to understand in the matter of naming the intermediate quarter points; but such is far from the truth. Each quarter point has as well defined a name as its more pretentious neighbor, the full point, and it matters not whether the compass is being boxed from north to east or east to north, when the particular quarter point is reached, it must be called by its proper name.

The name of the reverse point to any proposed point, is known at once without referring to the compass, by simply reversing the name—thus, the reverse of N is S, E is W, W½S is E½N, and so on.

Repeating the points is called "boxing the compass;" to do this, of course, is one of the first things a seaman learns. Usually this is about as far as the seaman goes with his compass education, but it is far from being enough.

The table of compass angles should be often referred to by the beginner, until it becomes thoroughly impressed on his mind.

The next thing to be mastered is the number of degrees and minutes in the various points. The student of today who takes a pride in his profession, will learn to box the compass in degrees—that is to say, he will learn to tell off-hand how many degrees correspond to any given compass course reckoned in points and parts of a point.

Reading of the Compass by Degrees.—As we have already learned, the whole circumference of the compass, is divided into three hundred and sixty degrees (360°), and each degree into sixty minutes (60′). This furnishes a notation for the compass more minute, or smaller, than quarter or eighth points. We still reckon from the north and south points, towards east and west, thus, N 45° E, S 30° E, N 60° W, S 10° W, and not thus, E 60° N, E 75° S, W 30° N, W 80° S.

The next step is to learn the angle which each course or compass point and quarter point makes with the meridian. Meridians are imaginary lines running north and south and intersecting the true poles of the earth. North and south on the compass is called the meridian of the compass because this line may be regarded as coinciding with the imaginary meridian on which the vessel is located; that is, if it were possible to rule a north-and-south line on the surface of the sea, and you started your vessel off at either NE, NW, SE or SW, you would at once see that she was sailing on a course that made an angle of 45° from the meridian. But your compass will tell you the same thing. Again, supposing that you steered your vessel by compass NNE. What angle would you be making with the meridian? NNE is two points, or a 2-point course, or 22° 30′ from the meridian north, and so on with any other course on the compass. Angles between north and east and north and west are reckoned from the meridianal point north on the compass, and angles between south and east and south and west are measured from the meridianal point south. This is why north and south on the compass are marked zero, they being taken as the initial line. See compass diagram for this information.

As we have already seen, the circumferences of all circles, no matter how large or how small, are divided into 360 equal parts, and all angles are measured by them. Do not get the idea that the larger circle the greater the number of degrees it will contain. There will be more space between the marginal divisions of the larger circumference, but it will always contain the 360 degrees. If two compass cards of unequal size were laid the smaller on top of the larger so that their centers coincided it would be found that the degree lines radiating from the centers to the circumferences, would likewise coincide. A degree, therefore, is 1-360 of the circumference of any circle, no matter what size. One has only to bear in mind that all vessels are not equipped with the same size compasses (cards) by which the courses are made. Do not forget this important fact.

Steamboats can be steered much finer than sailing vessels, and courses are frequently set to degrees, expressed thus, N 60° E. This means 60 degrees to the eastward of north. Now, if we divide the 360° of the compass card by its 32 points, we will get 11° 15′, as the regular angular measure of one point; 5° 37′ 30″ for one-half a point; 2° 48′ 45″ for one-quarter of a point; 8° 26′ 15″ for three-quarters of a point; and by adding 11° 15′ for each additional point, we get 22° 30′ for two points; 33° 45′ for three points; 45° for four points; 56° 15′ for five points; 67° 30′ for six points; 78° 45′ for seven points and 90° for eight points.

All courses should be figured to degrees, and then if necessary the conversion can be made to points. (This will be explained more fully in "Shaping the Course.") Greater accuracy in navigation in relation to the compass is obtained by this method than by figuring it to the nearest quarter point. Chances of error in the application of variation and deviation to the compass courses are likewise lessened. The student should be familiar with the conversion of degrees into points and the reverse, as he would be in naming the points of the compass, all of which leads to a thorough knowledge of the sea clock. It is plainly seen that the conversion of one into the other is a natural result of the presence of both. Accuracy requires the expression in degrees of all compass work. Bear this in mind as it will help you in what is to follow .

Sailing vessels cannot be steered closer than a quarter of a point, and for their navigation a quarter point is roughly estimated as 3°. In practical work 3° is always reckoned a quarter of a point.

The angular measure of the various points and quarter points of the compass is given in the following table, and should be studied by the student. It is not necessary for the pupil to memorize the number of degrees, minutes and seconds in each point or quarter point. Memorize the number of degrees, minutes and seconds in a quarter of a point, in a half, in three-quarters, in one point, and each additional full point. The remainder of them will come to you as you have occasion to use them; but those already mentioned should be thoroughly learned before you can expect to use the others off-hand.

As the vessel's course, which is sometimes expressed in points and sometimes in degrees, is always reckoned from the north or south point, the student may refer at once, in using the tables, to the number of points or degrees in any course given by name. The tables following show the degrees, minutes and seconds in each quarter point of the compass, as well as the numerical value of each point and quarter point.

Table showing the names of the points and quarter points, number of the points and fractional points in each course, and the angle, or degree division, made by each with the meridian north and south; as well as the correct way of boxing the compass:

N to E—S to E	P'ts.	Degrees.	P'ts.	S to W—W to N
NORTH	0	0° 00′ 00″	0	SOUTH
N ¼ E	¼	2° 48′ 45″	¼	S ¼ W
N ½ E	½	5° 37′ 30″	½	S ½ W
N ¾ E	¾	8° 26′ 15″	¾	S ¾ W
N by E	1	11° 15′ 00″	1	S by W
N by E ¼ E	1¼	14° 03′ 45″	1¼	S by W ¼ W
N by E ½ E	1½	16° 52′ 30″	1½	S by W ½ W
N by E ¾ E	1¾	19° 41′ 15″	1¾	S by W ¾ W
NNE	2	22° 30′ 00″	2	SSW
NNE ¼ E	2¼	25° 18′ 45″	2¼	SSW ¼ W
NNE ½ E	2½	28° 07′ 30″	2½	SSW ½ W
NNE ¾ E	2¾	30° 56′ 15″	2¾	SSW ¾ W
NE by N	3	33° 45′ 00″	3	SW by S
NE ¾ N	3¼	36° 33′ 45″	3¼	SW ¾ S
NE ½ N	3½	39° 22′ 30″	3½	SW ½ S
NE ¼ N	3¾	42° 11′ 15″	3¾	SW ¼ S
NE	4	45° 00′ 00″	4	SW
NE ¼ E	4¼	47° 48′ 45″	4¼	SW ¼ W
NE ½ E	4½	50° 37′ 30″	4½	SW ½ W
NE ¾ E	4¾	53° 26′ 15″	4¾	SW ¾ W
NE by E	5	56° 15′ 00″	5	SW by W
NE by E ¼ E	5¼	59° 03′ 45″	5¼	SW by W ¼ W
NE by E ½ E	5½	61° 52′ 30″	5½	SW by W ½ W
NE by E ¾ E	5¾	64° 41′ 15″	5¾	SW by W ¾ W
ENE	6	67° 30′ 00″	6	WSW
ENE ¼ E	6¼	70° 18′ 45″	6¼	WSW ¼ W
ENE ½ E	6½	73° 07′ 30″	6½	WSW ½ W
ENE ¾ E	6¾	75° 56′ 15″	6¾	WSW ¾ W
E by N	7	78° 45′ 00″	7	W by S
E ¾ N	7¼	81° 33′ 45″	7¼	W ¾ S
E ½ N	7½	84° 22′ 30″	7½	W ½ S
E ¼ N	7¾	87° 11′ 15″	7¾	W ¼ S
EAST	8	90° 00′ 00″	8	WEST
E ¼ S	7¾	87° 11′ 15″	7¾	W ¼ N
E ½ S	7½	84° 22′ 30″	7½	W ½ N
E ¾ S	7¼	81° 33′ 45″	7¼	W ¾ N
E by S	7	78° 45′ 00″	7	W by N
ESE ¾ E	6¾	75° 56′ 15″	6¾	WNW ¾ W
ESE ½ E	6½	73° 07′ 30″	6½	WNW ½ W
ESE ¼ E	6¼	70° 18′ 45″	6¼	WNW ¼ W
ESE	6	67° 30′ 00″	6	WNW
SE by E ¾ E	5¾	64° 41′ 15″	5¾	NW by W ¾ W
SE by E ½ E	5½	61° 52′ 30″	5½	NW by W ½ W
SE by E ¼ E	5¼	59° 03′ 45″	5¼	NW by W ¼ W
SE by E	5	56° 15′ 00″	5	NW by W
SE ¾ E	4¾	53° 26′ 15″	4¾	NW ¾ W
SE ½ E	4½	50° 37′ 30″	4½	NW ½ W
SE ¼ E	4¼	47° 48′ 45″	4¼	NW ¼ W
SE	4	45° 00′ 00″	4	NW
SE ¼ S	3¾	42° 11′ 15″	3¾	NW ¼ N
SE ½ S	3½	39° 22′ 30″	3½	NW ½ N
SE ¾ S	3¼	36° 33′ 45″	3¼	NW ¾ N
SE by S	3	33° 45′ 00″	3	NW by N
SSE ¾ E	2¾	30° 56′ 15″	2¾	NNW ¾ W
SSE ½ E	2½	28° 07′ 30″	2½	NNW ½ W
SSE ¼ E	2¼	25° 18′ 45″	2¼	NNW ¼ W
SSE	2	22° 30′ 00″	2	NNW
S by E ¾ E	1¾	19° 41′ 15″	1¾	N by W ¾ W
S by E ½ E	1½	16° 52′ 30″	1½	N by W ½ W
S by E ¼ E	1¼	14° 03′ 45″	1¼	N by W ¼ W
S by E	1	11° 15′ 00″	1	N by W
S ¾ E	¾	8° 26′ 15″	¾	N ¾ W
S ½ E	½	5° 37′ 30″	½	N ½ W
S ¼ E	¼	2° 48′ 45″	¼	N ¼ W
SOUTH	0	0° 00′ 00″	0	NORTH

The inner diagram shows the face of the modern compass card, with the points and quarter points, and the degrees corresponding therewith. The next circle shows the division, or radial lines, corresponding to the full points and their fractions thereof. The next circle shows the abbreviated names of these points and quarter points. The next circle shows the number of the points and fractions of points in each course. The numbers placed around the circumference are the degrees and fractions of a degree corresponding to these full and fractional points; or the angle made by each with the meridian of the compass. North and south on the card is called the meridian of the compass, and from this meridian all courses are measured. It is marked zero on the card and theoretically coincides with an imaginary line of the same kind ruled on the surface of the earth. N and S on the card are always marked with an 0; hence, the reckoning starts from them.

The repetition of the entire list of these names, beginning with north and making the circuit towards the right, is called "boxing the compass." It will be seen from the above diagram that there are three different methods of boxing the compass; namely, by the name of the point, as N by E; by the number of the point, as "north one point east;" by the number of the degrees, etc., as N 11¼° E. There is no difference whatever, in any of these expressions, all meaning one and the same. The foregoing diagram shows the proper way of boxing the compass. There are other methods of boxing the compass; namely, the "Lake way" of backing up on some of the readings. This entire subject is fully and comprehensively treated in Lesson II.

Points and Degrees.—By consulting the foregoing diagram compass, it will be seen that all compass courses, whether expressed by name, or by the number of the point, or by its value in degrees, are reckoned from the two poles of the circle (north and south) and have their ending at the equator line of the compass card (east and west). Thus, the north and south points of the compass are zero, and the east and west have a numerical value of 8 points and an angular value of 90°. In the latter respect the system of notation used by geographers in reckoning latitude on the earth's surface, is similar to that used on the compass, only that the equatorial points are marked zero and the poles 90°. An amplitude (the bearing of a celestial body—the sun, moon or stars—at rising reckoned from the east and west points, or the prime vertical) is measured by this system.

The student should examine the compass card and see how many courses of each kind there are, bearing in mind that there is nothing greater than an 8-point, or 90-degree course, which is always east and west.

Proper Method of Boxing the Compass.—The proper way of "boxing the compass" would be to start with north, and read to east, thence from south to east, thence from south to west, and thence from north to west. The reason for this is that when you read from N to E, S to E, S to W and N to W (from 0° to 90°) you are always counting toward a higher denomination, but if you were to read from E to S and W to N, it would be like counting backwards, that is, from 90° down to 0°. Do you see the point? By carefully examining the compass diagram, or table of angles, you can easily discover the principle upon which this system is based. Now, remember this, as it will help you to learn and memorize the reading of the compass the correct way.

In boxing, or reading the compass you should name each point and quarter point as you come to it, and not back up on any of the readings of courses, as is customary with the average sailor, both on the lakes and oceans. There is a right way and a wrong way. The right way has a reason, or principle, while the other has not. There is not a person that boxes the compass according to this old custom that can tell you the reason why he does it. He doesn't know. How common it is to hear a sailor say *NE by N ½ N* instead of NNE ½ E. It is much easier to say NNE ½ E than NE by N ½ N. It is much easier to learn to box the compass the correct way than the wrong way, because you have a principle to go by, whereas there is none to the other.

Where this method of boxing the compass originated is hard to tell; though it may be said, it is of old-time origin. Sailors of the old school had a whim for turning everything topsy turvy—getting the cart before the horse, as it were, if for nothing more than the sake of oddity.

Hence, this custom has undoubtedly been handed down from father to son. Compare the two methods.

However, mention is made of this method by some writers who claim that it is much more convenient to name the half and quarter points in this manner, admitting as they do, that it is a sacrifice of system for simplicity. They agree it would of course be more systematic, as a matter of geometry, to reckon the quarter points always from N to S, because the ship's course is reckoned from the meridian. Where the advantage is to be gained in "backing up" on these readings of the compass as already stated, is more than we can see.

We'll admit that quite as accurate navigation can be done by boxing the compass in this slip-shod way as by the correct way. The question then suggests itself would it not be advantageous for the lake navigator to change the reading of the compass in this respect? The suggestion relates to the benefits to be derived from one or the other. In the slip-shod method the only convenience there is is in continuing a habit, whereas in the correct method there is the ultimate advantage to lake navigators of being brought into accord with the whole range of nautical literature--a small change with a great result, at least to the rising generation of navigators.

We know of no book on navigation which is based upon this principle. All government sailing directions, bearings in lighthouse books, courses printed on charts, in coast pilots, etc., box the compass according to the proper way. We know of a great many cases where lake captains have found it a difficult matter to understand the courses as they are given on the charts, simply because they did not know how to box the compass the correct way. For instance, NNE ¾ E would be NE by N ¼ N to him, and from his lack of knowledge on the subject, the lake captain would be unable to make the conversion of the one into the other. The student of the compass should learn to box the compass both ways. To a person who is familiar with both methods it makes no difference which way the card is read, or in which manner the course is given him.

To box the compass backwards is to read the courses, or directions, from north continuously to the left back to north, that is, from north by way of west, south and east. Again, the compass may be boxed by naming each reverse point, starting as usual with north, thus: North, the reverse of which is south, N ¼ E—S ¼ W, N ½ E—S ½ W, N ¾ E—S ¾ W, N by E—S by W, and so on all the way round. Examine the compass diagram again and you will catch the meaning of same.

The points and quarter points of the compass also have a numerical value, or number, as well as by name and degree; as north-one-point-east would likewise be N by E, and N 11° 15′ E; there being no difference whatever in the three expressions. South-three-points-east would be the same thing as SE by S, or S 33° 45′ E, and so on. By consulting your table of compass points and angles, you will understand what this means. Should you receive such an order as "south-two-points-east," you would understand it as an SSE course, and head the ship accordingly. Should you be told to head the ship "south-five-and-a-half-points-west," you would bring the ship's head to SW by W ½ W. It is very essential that the navigator should be familiar with this mathematical arrangement of the compass card, as it is the foundation of dead-reckoning and other problems of navigation.

It will now be seen that there are several different ways of boxing the compass. These are by repeating the names assigned to each of the points and quarter points, by the number of points and fractions of points in each course reckoned from north and south, and by the number of degrees made by each point and fractional point from the meridian.

The next thing to be learned is the number of points in each course; how many courses of each kind there are and why they are so named.

The points are counted, as you will see by referring to the table of angles, from north and south around to east and west. There are then four one-point courses—N by E, N by W, S by E and S by W. There are then four two-points courses—NNE, NNW, SSE and SSW. There are four of each other kind of courses, as you will see by referring to the table, except the eight-point courses, east and west, and the meridian courses, north and south, or as follows:

2 meridian courses—north and south.

4 one-point courses—N by E, N by W, S by E and S by W.

4 two-point courses—NNE, NNW, SSE and SSW.

4 three-point courses—NE by N, NW by N, SE by S and SW by S.

4 four-point courses—NE, NW, SE and SW.

4 five-point courses—NE by E, NW by W, SE by E and SW by W.

4 six-point courses—ENE, WNW, ESE and WSW.

4 seven-point courses—E by N, W by N, E by S and W by S.

2 eight-point courses—east and west.

It is to be understood that each quarter point has a value in the number of points in each course, for instance, N by E ¼ E, is a one-and-a-quarter-point course, of which there are four in number, N by W ¼ W, S by E ¼ E, and S by W ¼ W.

Again, NE ½ N is a three-and-a-half-point course, because it is three and a half points from north. There are also four three-and-a-half-point courses, as will be seen by referring to the table again. Now, why are these called one-point courses, two-point courses, three-point courses, four-and-a-half-point courses, etc.? Because they are that number of points and quarter points from either north or south. There are four one-quarter-point courses, which are N ¼ E, N ¼ W, S ¼ E and S ¼ W, and so on. See compass card for this information.

Now, we'll see where the advantage is to be derived in being acquainted with this system of naming the point courses. For a person unacquainted with same and desiring to express himself, thus, instead of saying "in boxing the compass the correct way, you should repeat the name of each point, together with its fractional part, four times, except the *three-point courses* and the *seven-point courses*," he would have to say "* * * except on the points *NE by N, SE by S, SW by S and NW by N, and E by N, E by S, W by N and W by S*." Again, supposing the untutored desired to say that the "deviation of his compass was more on the *6, 7 and 8-point courses* than on the *1, 2 and 3-point courses*," he would have to say, "the deviation on the courses *ENE, WNW, ESE* and *WSW*, and on *E by N, E by S, W by N and W by S*. is more than it is on the courses *N by E, N by W, S by E* and *S by W*, and on *NNE, NNW, SSE, SSW*, and on *NE by N, NW by N, SE by S* and *SW by S*," a good deal of talk, but little said. Which is the more intelligible? It seems needless to say.

These point courses are again named according to the number of degrees, minutes and seconds they represent from north and from south, in a manner similar to the system enumerated above. There are two 90° courses, east and west, which are the 8-point courses. There are two zero, or meridian courses, north and south. There

are four of every other kind of degree courses—four eleven-degree-fifteen minute courses, which are the 1-point courses, N by E, N by W, S by E and S by W; there are four 22° 30′ courses, which are the 2-point courses: NNE, NNW, SSE and SSW; four 33° 45′ courses, which are the 3-point courses: NE by N, NW by N, SE by S and SW by S; four 45° courses, which are the 4-point courses: NE, NW, SE and SW. In addition to being called 4-point courses and 45° courses, they are also called the inter-cardinal points, because they lie midway between the cardinal points; they are also called quadrantal points, deriving their name from the four quadrants of the compass. There are four 56° 15′ courses, which are the 5-point courses; four 67° 30′ courses, which are the 6-point courses; four 78° 45′ courses, which are the 7-point courses. There are four of each other kind of degree courses, as you will see by examining the table of compass angles.

The student should learn this system of naming the point courses thoroughly as it will help him a great deal in compass work. It will also help him to learn to box the compass the proper way. Remember, that in boxing the compass properly you repeat the name of each point and its quarter points four times except the 3-point courses and the 7-point courses, which are only named once. Thus, N, N ¼ E, N ½ E, N ¾ E, north appears four times. N by E, N by E ¼ E, N by E ½ E, N by E ¾ E; N by E appears four times. NNE, NNE ¼ E, NNE ½ E, NNE ¾ E; NNE appears four times. NE by N (a 3-point course, therefore, only named once). NE ¾ N, NE ½ N, NE ¼ N, NE; NE is named four times, and so on all the way round.

After naming the 3-point courses you start with the 4-point courses and read ¾ either north or south, as the case might be. This then is a 3¼-point course. We really back up on the readings from the 4-point to the 3¼-point courses, bpt we couldn't say NE by N ¼ E for NE ¾ N. Remember, what has been said and you will have no trouble. Study the compass card comprehensively anl you will see why all these things are.

If you box the compass by naming each point and quarter point as you come to it, it will not bother you to read from north to east, or from north to west (0° to 90°), but if you attempt to go from east to south and west to north (90° to 0°) on the same principle you'll get badly tangled. Just try it and see. That is the reason for telling you before to read from N to E and thence from S to E, and then S to W, and then N to W. If you read either from E to S or W to N you'll be reading backwards. As soon as you learn to box the compass according to this principle, you can go all the way round, from north back to north by way of east, without the least trouble.

From N to E (not E to N) is called the first or NE quadrant; from S to E (not E to S) is the second, or SE quadrant; from S to W is the third, or SW quadrant, and from N to W is called the fourth, or NW quadrant.

Note.—In all practical compass work the seconds and minutes are discarded, and the course is figured to the nearest even degree. The degree is the smallest marginal division on the compass card, and in either steering or taking compass bearings, if it is figured to the degree, it is considered close work. The seconds are discarded entirely, but in the case of the minutes they are discarded when less than 30, but when 30, or more than 30, they are called a whole degree. For an example: If you were told to steer N 11° 15′ E, and you had a compass with degrees marked on its margin, you would put her on the even 11°. Supposing you were told to steer S 5° 37′ 30″ E you would call it 6° even. N 33° 45′ W would be N 34° W.

Remember that north and south are the reckoning, or starting points of the compass, and that all courses are reckoned from them, and that is why they are marked zero in the table as well as on the face of a compass card. They are called meridian courses because meridians run north and south. N ½ E, N ½ W, S ½ E and S ½ W are all numbered ½-point courses because they are just one-half of a point from the reckoning points, and this is the reason that they are so numbered in the table, and so on with the remainder of the compass points.

The greatest course we can have is 90°, or 8 points, which is either east or west. As soon as you get over 8 points it is necessary to reckon from the other way, that is, subtract the number from 16 points, or 180°. For an example, the course is 10 points right of north and subtracting this from 16 points will give 6 points left of south, or ESE. You will understand this more fully when you get to correcting courses for variation and deviation.

The student should now be able to answer with facility all such questions as these:

How many points to the compass; how many degrees; how many cardinal points, name them; how many inter-cardinal points, name them, and why are they so named?

From whence does the point NNE derive its name, and how does the point S by W get its name? How does W ½ S get its name?

How many points is it between each cardinal point? How many points is it between one inter-cardinal point and the next inter-cardinal point to it?

How many points is it from E ½ N to SSE ½ E? How many points is it from N by W to S by W ½ W? How many points is it from NE by E to S by W? What points are 5 points on either side of SSE? What points are 10 points on either side of SW? What points are 8 points on either side of north? What point is 16 points on either side of south?

How many quadrantal points are there? Name them.

How many points in 360°, in 90°, in 180°, in 135°, in 25°?

How many degrees in one point of the compass? In a quarter, half and three-quarters? How many in 5½ points?

How do you know that there are 11° 15′ in 1 point? Because the compass card is divided into 360°, and is also divided in 32 divisions called points; then if there are 32 points in all each point will contain as many degrees as 32 are contained times in 360°, which is 11° 15′.

From which points of the compass do you reckon degrees, and towards which points?

What points of the compass are marked zero, and what points are marked 90°?

Why is it improper to reckon the degrees on the compass from east and west toward north and south?

What is the difference between S 45° E and SE? What is the difference between S 22° 30′ W and SSW? What is the difference in degrees between N 33° 45′ W and NW?

What is the difference in points between S 56° 15′ E and SE by E ½ E?

How many one-point courses are there? Name them.

How many:

Meridian courses; 8-point courses; ½-point courses; 2½-point courses; 6¾-point courses; 90° courses; 14° courses; 34° courses are there? Name them.

What is the difference between:

An 8-point course and a 90° course?

A 5-point course and a 56° 15′ course?

A 5° 37′ 30″ course and a ½-point course?

How many of each kind of courses are there in points; in degrees?

Why is NE called a 4-point course—why is it called a 45° course—why is it called a quadrantal point—why an inter-cardinal point?

Why is S by W ½ W called a 1½-point course? How many 1½-point courses are there? Name them.

Express SSW so that it will mean the same thing in two other ways.

What is the difference between SE ¼ and S-4¼-points-E? What is the difference between W ¾ N and N-7¼-points-W?

What is the difference between N-3¼-points-E and NE ¾ N?

If you were told to head your vessel N-5-points-W, how would your compass read?

Supposing that you were told to head your vessel S 56° E, and your compass had no degree marks on it, as in the majority of cases, what course, or point, would you put her on?

What is the difference between SSW ¼ W and SW by S ¾ S? Which is correct?

What is the difference between ENE ¾ E and E by N ¼ N, and which is correct?

How many degrees is it from S by W to ESE.

What is the included angle between ESE and E in points and in degrees? Between SW and W by S? Between S ¾ W and SSE.

The student should be as familiar with the number of points and degrees in each course as he is with its name. He should also be able to answer instantly any of the foregoing questions. No one can claim familiarity with the compass who cannot do this. Have the compass card pictured in your mind, and so thoroughly imprinted, that the moment a question is asked concerning it, either by yourself, or someone else, you can at once see the relationship existing between the points and degrees and vice versa.

Compare correct way of boxing the compass with the "lake" method. See table following:

The Correct Way of Boxing the Compass.		The "Lake" Way of Boxing the Compass.
NORTH	0	NORTH
N ¼ E	¼	N ¼ E
N ½ E	½	N ½ E
N ¾ E	¾	N ¾ E
N by E	1	N by E
N by E ¼ E	1¼	N by E ¼ E
N by E ½ E	1½	N by E ½ E
N by E ¾ E	1¾	N by E ¾ E
N N E	2	NNE
NNE ¼ E	2¼	NE by N ¾ N
NNE ½ E	2½	NE by N ½ N
NNE ¾ E	2¾	NE by N ¼ N
NE by N	3	NE by N
NE ¾ N	3¼	NE ¾ N
NE ½ N	3½	NE ½ N
NE ¼ N	3¾	NE ¼ N
NE	4	NE
NE ¼ E	4¼	NE ¼ E
NE ½ E	4½	NE ½ E
NE ¾ E	4¾	NE ¾ E
NE by E	5	NE by E
NE by E ¼ E	5¼	NE by E ¼ E
NE by E ½ E	5½	NE by E ½ E
NE by E ¾ E	5¾	NE by E ¾ E
ENE	6	ENE
ENE ¼ E	6¼	E by N ¾ N
ENE ½ E	6½	E by N ½ N
ENE ¾ E	6¾	E by N ¼ N
E by N	7	E by N
E ¾ N	7¼	E ¾ N
E ½ N	7½	E ½ N
E ¼ N	7¾	E ¼ N

The Correct Way of Boxing the Compass.		The "Lake" Way of Boxing the Compass.
EAST	8	EAST
E ¼ S	7¾	E ¼ S
E ½ S	7½	E ½ S
E ¾ S	7¼	E ¾ S
E by S	7	E by S
ESE ¾ E	6¾	E by S ¼ S
ESE ½ E	6½	E by S ½ S
ESE ¼ E	6¼	E by S ¾ S
ESE	6	ESE
SE by E ¾ E	5¾	SE by E ¾ E
SE by E ½ E	5½	SE by E ½ E
SE by E ¼ E	5¼	SE by E ¼ E
SE by E	5	SE by E
SE ¾ E	4¾	SE ¾ E
SE ½ E	4½	SE ½ E
SE ¼ E	4¼	SE ¼ E
SE	4	SE
SE ¼ S	3¾	SE ¼ S
SE ½ S	3½	SE ½ S
SE ¾ S	3¼	SE ¾ S
SE by S	3	SE by S
SSE ¾ E	2¾	SE by S ¼ S
SSE ½ E	2½	SE by S ½ S
SSE ¼ E	2¼	SE by S ¾ S
SSE	2	SSE
S by E ¾ E	1¾	S by E ¾ E
S by E ½ E	1½	S by E ½ E
S by E ¼ E	1¼	S by E ¼ E
S by E	1	S by E
S ¾ E	¾	S ¾ E
S ½ E	½	S ½ E
S ¼ E	¼	S ¼ E
SOUTH	0	SOUTH
SOUTH	0	SOUTH
S ¼ W	¼	S ¼ W
S ½ W	½	S ½ W
S ¾ W	¾	S ¾ W
S by W	1	S by W
S by W ¼ W	1¼	S by W ¼ W
S by W ½ W	1½	S by W ½ W
S by W ¾ W	1¾	S by W ¾ W
SSW	2	SSW
SSW ¼ W	2¼	SW by S ¾ S
SSW ½ W	2½	SW by S ½ S
SSW ¾ W	2¾	SW by S ¼ S
SW by S	3	SW by S
SW ¾ S	3¼	SW ¾ S
SW ½ S	3½	SW ½ S
SW ¼ S	3¾	SW ¼ S
SW	4	SW
SW ¼ W	4¼	SW ¼ W
SW ½ W	4½	SW ½ W
SW ¾ W	4¾	SW ¾ W
SW by W	5	SW by W
SW by W ¼ W	5¼	SW by W ¼ W
SW by W ½ W	5½	SW by W ½ W
SW by W ¾ W	5¾	SW by W ¾ W
WSW	6	WSW
WSW ¼ W	6¼	W by S ¾ S
WSW ½ W	6½	W by S ½ S
WSW ¾ W	6¾	W by S ¼ S
W by S	7	W by S
W ¾ S	7¼	W ¾ S
W ½ S	7½	W ½ S
W ¼ S	7¾	W ¼ S
WEST	8	WEST
W ¼ N	7¾	W ¼ N
W ½ N	7½	W ½ N
W ¾ N	7¼	W ¾ N
W by N	7	W by N
WNW ¾ W	6¾	W by N ¼ N
WNW ½ W	6½	W by N ½ N
WNW ¼ W	6¼	W by N ¾ N
WNW	6	WNW
NW by W ¾ W	5¾	NW by W ¾ W
NW by W ½ W	5½	NW by W ½ W
NW by W ¼ W	5¼	NW by W ¼ W
NW by W	5	NW by W
NW ¾ W	4¾	NW ¾ W
NW ½ W	4½	NW ½ W
NW ¼ W	4¼	NW ¼ W
N W	4	NW
N W ¼ N	3¾	NW ¼ N

The Correct Way of Boxing the Compass.		The "Lake" Way of Boxing the Compass.
NW ½ N	3½	NW ½ N
NW ¾ N	3¼	NW ¾ N
NW by N	3	NW by N
NNW ¾ W	2¾	NW by N ¼ N
NNW ½ W	2½	NW by N ½ N
NNW ¼ W	2¼	NW by N ¾ N
NNW	2	NNW
N by W ¾ W	1¾	N by W ¾ W
N by W ½ W	1½	N by W ½ W
N by W ¼ W	1¼	N by W ¼ W
N by W	1	N by W
N ¾ W	¾	N ¾ W
N ½ W	½	N ½ W
N ¼ W	¼	N ¼ W
NORTH	0	NORTH

BOOK REVIEWS.

"Steam Turbines" by William Gentsch. Translated from the German by Arthur R. Liddell, New York. Longmans, Green & Co. 375 pages. Numerous illustrations and 19 plates. 7½ x 10 inches. Cloth. Supplied by the MARINE REVIEW.

The author of this book states in his preface that he has endeavored to treat the subject of "Steam Turbines" in a popular manner, and, so far as possible, to cover all the ground. He has endeavored to divide the systems of construction hitherto known into two groups, for which two designations have been made use of—those of "Velocity Turbine" and "Pressure Turbine." The book has an introductory chapter comprising a short historical discussion of the steam turbine, and giving its classification under the author's system. The various forms of turbines in both classes are taken up and described, and then the description deals with the parts more in detail. The scope of the book can be determined by a glance over the more important chapter headings. Some of these are, "Combinations of Pressure and Velocity Turbines," "Compound Arrangements," "Means for Reducing the Number of Revolutions Per Minute," "The Use of Superheated Steam," "Utilization of the Exhaust," "Internal Resistance," "Governing Appliances," "Reversing Gear," "Clearance Space Packings," etc. Separate chapters are devoted to turbine pumps and blowers, turbines for land vehicles and turbines for use on ship board. The last few pages of the book comprise a list of patent specifications made use of in the preparation of the volume.

The author has not entered into the theory of the machine to any great extent. The book is largely devoted to descriptions of the various forms of turbines, which have been developed and includes many different systems. It is not a book on turbine theory or turbine design. It covers a wide range, however, and the reader can obtain a vast amount of information regarding the various systems which have been developed. The book is open to serious criticism in several respects. Other than the chapter headings, there are no subdivisions to the work, making it somewhat difficult to obtain information regarding any definite machine. The most serious criticism that can be offered is in regard to the illustrations. These are well executed, but, unfortunately, the captions under each illustration have been omitted. There is absolutely nothing to show what the illustration is, and it is necessary to read through the text, in order to gain any information whatever regarding the illustration. The text, in some cases, is three or four pages from the illustration, and, to most readers, this is apt to prove so annoying that the book will be laid aside in a short time and only used when absolutely necessary.

"The Directory of Ship Owners, Ship Builders and Marine Engineers for 1906." London. The Directory Publishing Co., Ltd. 636 pages. 5½ x 8½ inches. Cloth. Price $2.50. Postage and duty extra.

This book is compiled chiefly from official sources and is a directory, as its title indicates, of the ship owners, ship builders and marine engineers of Great Britain. The present edition has been thoroughly revised and brought up-to-date, and contains a great amount of information of use to ship owners, ship builders, marine engineers, ship brokers, shipping agents, builders of ship building machinery and material, etc.

The book contains an index to the names of ship owners, ship builders and marine engineers, and a similar index alphabetically arranged in the order of towns, an index to the names of boats, a personal index to the directors, partners and chief officials of ship owning, ship building and marine engineering firms and companies and a list of manufacturers and suppliers of ship building and marine engineering plant and material.

"Valve Gears for Steam Engines" by Cecil H. Peabody, New York. John Wiley & Son. 142 pages with 32 plates. 6 x 9 inches. Cloth. Supplied by the MARINE REVIEW for $2.50.

This is the second edition of this well known work on valve gears. The book is intended for the use of engineering students, giving instruction in the theory and practice of valve gear design for steam engines. The author states that he has not attempted to give an exhaustive treatment of the subject, but rather to enable the learner to obtain a firm grasp of the principles involved and some facility in their application.

Many types of valve gears are discussed, and each type is illustrated by one or more examples selected from good practice. Graphic methods are used throughout the body of the book, both for demonstration of principles and for design of gears.

An appendix contains analytical descriptions of certain principles which cannot be treated in a complete and satisfactory method by graphics alone. The author uses the Zeuner valve diagram throughout the work.

The book is divided into six chapters dealing, respectively, with the plain slide valve, shifting eccentrics, link motions, radial valve gears, double valve gears and drop cut-off valve gears. The appendix, as heretofore stated, contains mathematical discussions and will probably be passed over by the average reader.

A very commendable feature of the book is the arrangement of illustrations. These are omitted entirely from the body of the work, and are gathered together in a set of 32 insert plates at the back of the book. The inner portion of the plate is blank, so that when it is unfolded, the entire illustration is outside the page, enabling the reader to refer to it without any turning of pages. This is an idea that might be well copied in many other text books.

"Huntington's Tables" by Robert Huntington, 150 State street, Boston. Robert Huntington, publisher. 26 pages. 8 x 10½ inches. Paper. Supplied by the MARINE REVIEW for $1.

This is the first edition of Huntington's tables for turning standard into local apparent time and vice versa. It shows how to find the deviation of the compass by the sun and stars and also by the use of Arbecam's alidade. The tables given are very clear.

WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Jones Building, Detroit, Mich., June 4, 1906. Sealed proposals for widening St. Marys' Falls Canal will be received at this office until 2 p. m., July 24, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col. Engrs.

U. S Engineer Office, Room 508, Federal Bldg., Chicago, Ill., May 26, 1906. Sealed proposals for concrete superstructure in Chicago Harbor, Ill., will be received here until noon, June 30, 1906, and then publicly opened Information on application. W. H BIXBY, Lt. Col., Engrs.

U. S. Engineer Office, Milwaukee, Wis., June 1, 1906. Sealed proposals for building crib extensions of 100 feet each to breakwaters at Sheboygan and Kenosha Harbors, Wisconsin, will be received here until 3 P. M., standard time, June 27, 1906, and then publicly opened. Information furnished on application. W. V. Judson, Major, Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., June 11, 1906. Sealed proposals for dredging Shoal 28 in Mud Lake, St. Mary's River, Mich., will be received at this office until 2 p. m. July 11, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col. Engineers.

SEALED PROPOSALS will be received at the office of the Light-House Board, Washington, D. C., until 2 o'clock P. M. July 17th, 1906, and then opened, for furnishing the materials and labor of all kinds necessary for the construction and delivery of the single-screw steel steam light-house tender Anemone.

WANTED.—Master Shipfitter (outside), $6.00 per diem. A competitive examination will be held for the above position July 12, 1906. For further information address "Commandant, Navy Yard, Portsmouth, N. H."

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One 200-h. p. Tregurtha Boiler.
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One Providence Windlass, 50 fathoms 1½ in. chain.
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FOR SALE.—At a bargain, side-wheel transfer boat Delta; 226 x 45½ feet — 231 x 74 feet over all—7 feet deep. Ainslee-Cochran engines, 23¾ x 7 feet stroke, 12 foot bucket, 2 doctor pumps, 2 donkey pumps, double engine capstan 6 x 14 inches. Machinery as good as new; 4 boilers, 44 inches by 26 feet, allowed 156 pounds steam. Will sell altogether or separately. Address W. J. Kelleher, Q. & C. R. R. Co., New Orleans, La.

Steamer T. S. Christie.

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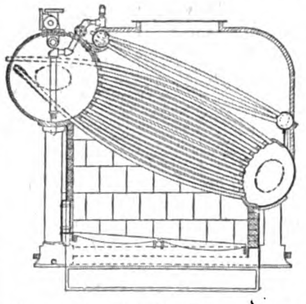

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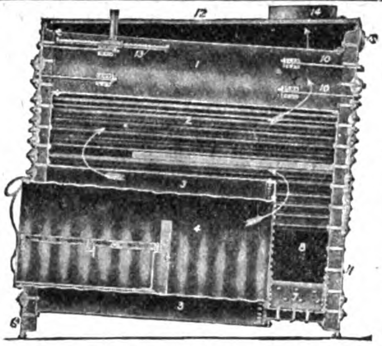

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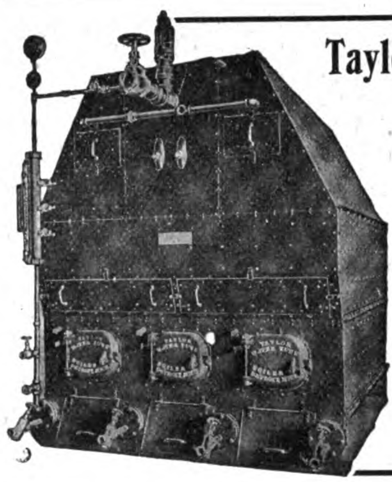

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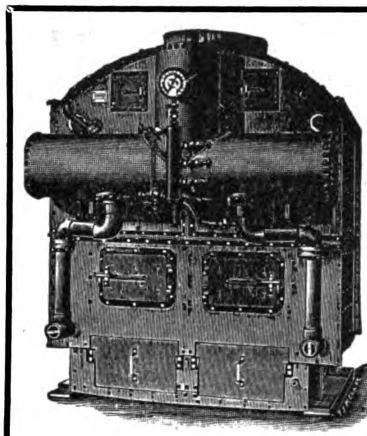

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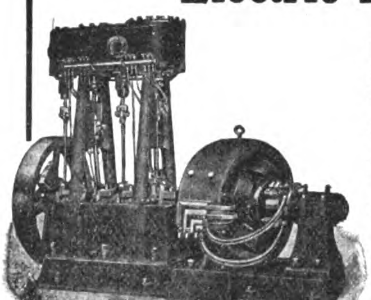

which we can guarantee

to stand up under extreme changes from no load to full load, and to REGULATE TO PERFECTION.
That its construction is strong is self-evident
The shaft, rods, valve stems and other working parts are made of forged steel.
Every bearing is automatically lubricated.
In finish it is all that can be desired.

Write for full particulars and tests.

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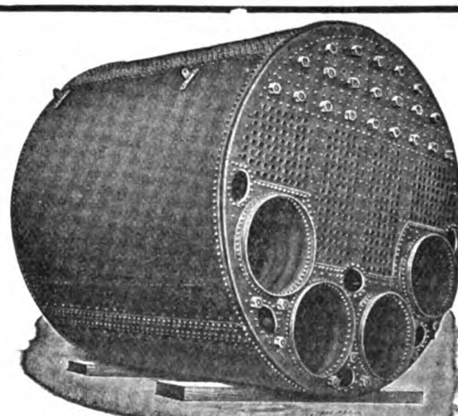

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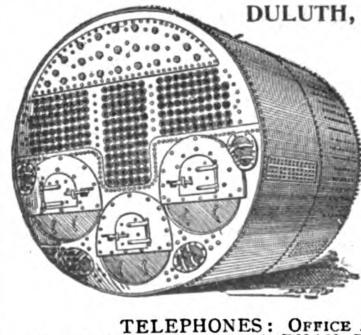

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J. H. OPPERMAN, *Secretary*, 579-R; E. KRIZ, *Superintendent*, 557-M.

BUYERS' DIRECTORY OF THE MARINE TRADE.

For a more complete classification than that represented by advertisers in The Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, Marine and Naval Directory of the United States, published by The Marine Review, Cleveland.

[See accompanying Index of Advertisers for full addresses of concerns in this Directory.]

AIR COMPRESSION, HOISTS, ETC.
Great Lakes Engineering Works.... ....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co......... .... New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co...... .... Quincy, Mass.
Great Lakes Engineering Works.... .... Detroit.

ANCHORS.
Bowers, L. M. & Co................ ....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co........ .... Cleveland.
Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works.... .... Detroit.

ASH EJECTORS.
Great Lakes Engineering Works.... .... Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J........Cleveland.
Goulder, Holding & Masten........ .... Cleveland.
Hoyt, Dustin & Kelley....Cleveland.
Jenkins, Russell & Eichelberger.... ....Cleveland.
Kremer, C. E. ....Chicago.
MacDonald, Ray G.........Chicago.
Shaw, Warren, Cady & Oakes...... .... Detroit.
White, Johnson, McCaslin & Cannon ....Cleveland.

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.............. ....Brookline, Mass.

BELTING (LEATHER.)
Republic Belting & Supply Co...... .... Cleveland.

BLOCKS, SHEAVES, ETC.
Boston Lockport Block Co........ ....Boston, Mass.

BOAT BUILDERS.
Drein, Thos. & Son............... ....Wilmington, Del.
Kahnweiler's Sons, David.......... ....New York.
Marine Construction & D. D. Co.. ....Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co............. ....St. Joseph, Mich.

BOILER COMPOUNDS.
The Bird-Archer Co......New York
Dearborn Drug & Chemical Works.. ....Chicago.
State Manufacturing Co...Cleveland.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co........ ....Providence, R. I.

BOILER MANUFACTURERS—Continued.
American Ship Building Co......... .... Cleveland.
Atlantic Works..East Boston, Mass.
Chicago Ship Building Co..Chicago.
Cramp, Wm. & Sons..Philadelphia.
Dearing Water Tube Boiler Co.... ....Detroit.
Detroit Ship Building Co....Detroit.
East End Boiler Works....Detroit.
Fletcher, W. A. & Co............. ....Hoboken, N. J.
Fore River Shipbuilding Co........ ....Quincy, Mass.
Great Lakes Engineering Works.... .... Detroit.
Kingston Foundry & Machine Works ....Oswego, N. Y.
Maryland Steel Co.................. ....Sparrow's Point, Md.
Milwaukee Dry Dock Co.......... ....Milwaukee.
Mosher Water Tube Co..New York.
Newport News Ship Building Co.. ....Newport News, Va.
New York Shipbuilding Co.......... .... Camden, N. J.
Northwestern Steam Boiler & Mfg. Co............. ....Duluth, Minn.
Quintard Iron Works Co.......... ....New York.
Roberts Safety Water Tube Boiler Co. ....New York.
Superior Ship Building Co........ .... Superior, Wis.
Taylor Water Tube Boiler Co.... .... Detroit.
Toledo Ship Building Co.......Toledo.

BOILER RIVETS.
Bourne-Fuller Co.........Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.......... ....Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons....Philidelphia.
Fore River Ship & Engine Co...... ....Quincy, Mass.
Great Lakes Engineering Works.. .... Detroit.
Lunkenheimer Co........Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co.... ....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co............... Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co........Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.........Buffalo.
Bunker, E. A...........New York.
Upson-Walton Co.........Cleveland.
Republic Belting & Supply Co.... ....Cleveland.

CAPSTANS.
American Ship Windlass Co........ .... Providence, R. I.
Dake Engine Co.................... ....Grand Haven, Mich.
Hyde Windlass Co........Bath, Me.
Marine Mfg. & Supply Co.......... ....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co................ ....Jersey City, N. J.

CHAIN SURVEYORS, HOISTS.
Brown-Hoisting Machinery Co...... ....Cleveland.
General Electric Co................ ....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co...... .... Boston, Mass.
Republic Belting & Supply Co...... ....Cleveland, O.

CHARTS.
Penton Publishing Co....Cleveland.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons............. .... Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co........Cleveland.
Pickands, Mather & Co....Cleveland.
Pittsburg Coal Co........Cleveland

COAL AND ORE HANDLING MACHINERY.
Brown-Hoisting Machinery Co...... ....Cleveland.

COMPASSES.
Ritchie, E. S. & Son............... .... Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works.... .... Detroit.
Thropp & Sons Co., John E......... .... Trenton, N. J.
Wheeler Condenser & Engineering Co.................... New York.

CONTRACTORS FOR PUBLIC WORKS.
Breymann Bros., G. H.......Toledo.
Buffalo Dredging Co.........Buffalo.
Dunbar & Sullivan Dredging Co.... ....Buffalo.
Graves & Stephens ......Cleveland.
Great Lakes Dredge & Dock Co.... .... Chicago.
Hickler Bros......... ....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H... .... Milwaukee.
Standard Contracting Co..Cleveland.
Sullivan, M................ Detroit.

CORDAGE.
Baker & Co., H. H..........Buffalo.
Upson-Walton Co........Cleveland.

Buyers' Directory of the Marine Trade.—*Continued.*

CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co...... .... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son........Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co........Buffalo.
Dunbar & Sullivan Dredging Co.... .... Buffalo.
Great Lakes Dredge & Dock Co.. .... Chicago.
Hickler Bros. ....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H... ....Milwaukee.
Sullivan, M............... Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.

DRY DOCKS.
American Ship Building Co........ .... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co......Buffalo.
Chicago Ship Building Co.......... .... Chicago
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co.......... .... Detroit
Great Lakes Engineering Works.... .... Detroit.
Lockwood Mfg. Co................ ....East Boston, Mass.
Milwaukee Dry Dock Co........... ....Milwaukee.
Newport News Ship Building Co... ....Newport News, Va.
Shipowners' Dry Dock Co.Chicago.
Superior Ship Building Co........ .... Superior, Wis.
Tietjen & Lang Dry Dock Co...... .... Hoboken, N. J.
Toledo Ship Building Co......Toledo.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.......... .... Manitowoc, Wis.

DYNAMOS.
General Electric Co............... ....Schenectady, N. Y.
Thropp & Sons, John E............ ....Trenton, N. J.

ELECTRIC HOISTS AND CRANES.
General Electric Co............... ....Schenectady, N. Y.

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co................. ....Schenectady, N. Y.
Thropp & Sons, John E............. ....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co......... .... Cleveland.
Atlantic Works, East Boston, Mass.
Chicago Ship Building Co., Chicago.
Chase Machine Co........Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.
Fore River Shipbuilding Co........ .... Quincy, Mass.

ENGINE BUILDERS—Continued.
Great Lakes Engineering Works.... .... Detroit, Mich.
Hall Bros. .... Philadelphia.
Lockwood Mfg. Co................ ....East Boston, Mass.
Maryland Steel Co................. ....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.........New York.
Newport News Ship Building Co.... ....Newport News, Va.
New York Ship Building Co........ ....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. .... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard......Chester, Pa.
Sheriffs Mfg. Co.........Milwaukee.
Superior Ship Building Co.......... .... Superior, Wis.
Thropp, J. E. & Sons Co........... ....Trenton, N. J.
Toledo Ship Building Co......Toledo.
Trout, H. G.................Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son......New York.
Marine Mfg. Supply Co., New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. ...... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. .... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander .... Cleveland.
Hunt, Robt. W. & Co......Chicago.
Kidd, Joseph..........Duluth, Minn.
Mosher, Chas. D........New York.
Nacey, James .... Cleveland.
Roelker, H. B...........New York.
Wood, W. J................Chicago.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co..........Troy, N. Y.
Wheeler Condenser & Engineering Co. .... New York.

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General Electric Co................. ....Schenectady, N. Y.

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Fore River Shipbuilding Co......... .... Quincy, Mass.

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Fix's S. Sons............Cleveland.

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Parker Bros. Co., Ltd......Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co........Cleveland.
Smith, Stanley B., & Co., Detroit.

FURNACES FOR BOILERS.
Continental Iron Works, New York.

GAS BUOYS.
Safety Car Heating & Lighting Co.. .... New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.......Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ...... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co......Cincinnati, O.

GENERATING SETS.
General Electric Co................. ....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph.......... ....Jersey City, N. J.

GREASE EXTRACTORS.
Greacen-Derby Engineering Co..... ....Perth Amboy, N. J.

HAMMERS, STEAM.
Chase Machine Co........Cleveland.

HOISTS FOR CARGO, ETC.
American Ship Building Co.......... .... Cleveland.
Brown Hoisting Machinery Co...... .... Cleveland.
Chase Machine Co.......Cleveland.
Dake Engine Co.................... ....Grand Haven, Mich.
General Electric Co......New York.
Hyde Windlass Co........Bath, Me.
Marine Iron Co............Bay City.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co.......... ....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works.... .... Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The......... .... New York.

ICE MACHINERY.
Great Lakes Engineering Works.... .... Detroit.
Roelker, H. B............New York.

INJECTORS.
American Injector Co......Detroit.
Jenkins Bros............New York.
Lunkenheimer Co. ...... Cincinnati.
Penberthy Injector Co............. .... Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co......Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T..........Duluth.
Hutchinson & Co.........Cleveland.
McCarthy, T. R..........Montreal.
McCurdy, Geo. L..........Chicago.
Mitchell & Co............Cleveland.
Parker Bros. Co., Ltd......Detroit.
Peck, Chas. E. & W. F............ ....New York and Chicago.
Prindiville & Co...........Chicago.
Richardson, W. C........Cleveland.
Sullivan, D. & Co..........Chicago.

THE MARINE REVIEW

VOL. XXXIII. CLEVELAND, JUNE 28, 1906. No. 26.


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WARD LINE "MERIDA"
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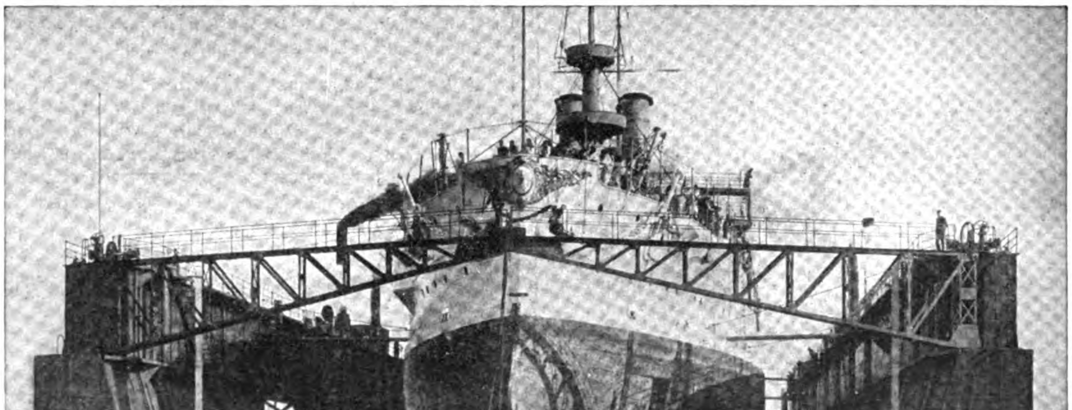
Marine Railway.
Repairs to all classes
of vessels
LARGE TURBINE
VIEW OF ONE OF OUR DRY DOCKS
Philadephia



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Buyers' Directory of the Marine Trade---*Continued.*

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Hanna, M. A. & Co........Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co..................St. Joseph, Mich.

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Armstrong Cork Co......Pittsburg.
Carley Life Float Co..................New York, N. Y.
Drein, Thos. & Son................ Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson...........Buffalo.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas................ Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph................Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ...... Cincinnati.

LUMBER.
Martin-Barriss Co. ...... Cleveland.

MACHINISTS.
Chase Machine Co........Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co...............East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia.

MARINE RAILWAYS.
Hickler Bros., Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I..............East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W..............New York

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.......................... Cleveland.
Detroit Ship Building Co., Detroit.
Great Lakes Engineering Works.......................... Detroit.

METALLIC PACKING.
Katzenstein, L. & Co., New York.
The National Metallic Packing Co..

MOTORS, GENERATORS—ELECTRIC.
General Electric Co................Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Ritchie, E. S., & Sons................. Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander ....Cleveland
Kidd, Joseph ....Duluth, Minn.
Mosher, Chas. D.........New York.
Nacey, James ....Cleveland
Wood, W. J................Chicago

OAKUM.
Stratford, Oakum Co.................Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph................Jersey City, N. J.

PACKING.
Jenkins Bros............New York.
Katzenstein, L. & Co...New York.
Robertson, Jos. L. & Sons.......New York.
The National Metallic Packing Co... Oberlin, O.
Republic Belting & Supply Co.....................Cleveland, O.

PAINTS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co........Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc. ..Philadelphia.

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co........Buffalo.
Dunbar & Sullivan Dredging Co.... Buffalo.
Great Lakes Dredge & Dock Co.... Chicago.
Hickler Bros..Sault Ste. Marie, Mich.
Hubbell Co., H. W...Saginaw, Mich.
Parker Bros. Co., Ltd.......Detroit.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H......Milwaukee.
Sullivan, M.................Detroit.

PIPE, WROUGHT IRON.
Bourne-Fuller Co......Cleveland, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co......Cleveland, O.
Otis Steel Co............Cleveland.

PRESSURE REGULATORS.
Ross Valve Co..........Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co........ Cleveland.
Atlantic Works ..East Boston, Mass.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Shipbuilding Co......... Quincy, Mass.
Great Lakes Engineering Works.... Detroit.
Hyde Windlass Co........Bath, Me.
Lockwood Mfg. Co...............East Boston, Mass.
Milwaukee Dry Dock Co..........Milwaukee.
Newport News Ship Building Co.................Newport News, Va.
Roelker, H. B..........New York.
Sheriffs Mfg. Co........Milwaukee.
Superior Ship Building Co.........Superior, Wis.
Thropp & Sons Co., J. E...........Trenton, N. J.
Toledo Ship Building Co......Toledo.
Trout, H. G...............Buffalo.

PROJECTORS, ELECTRIC.
General Electric Co..............Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.
Great Lakes Engineering Works.. Detroit.
Kingsford Foundry & Machine Works ....Oswego, N. Y.
Wheeler Condenser & Engineering Co. ....New York.

RANGES.
Stamford Foundry Co..................Stamford, Conn.

REFRIGERATING APPARATUS.
Great Lakes Engineering Works.... Detroit.
Roelker, H. B..........New York.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register......Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.
Bourne-Fuller Co.......Cleveland, O.

RUBBER SUPPLIES.
Republic Belting & Supply Co...... Cleveland, O.

SAFETY VALVES.
Lunkenheimer Co.........Cincinnati.

SAIL MAKERS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co........Cleveland.

SALVAGE COMPANIES.
See Wrecking Companies.

SEARCH LIGHTS.
General Electric Co...............Schenectady, N. Y.

SHEARS.
See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co......Cleveland, O.
Otis Steel Co............Cleveland.

SHIP BUILDERS.
American Ship Building Co......... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.......Buffalo.
Cramp, Wm. & Sons..Philadelphia.
Chicago Ship Building Co..Chicago.
Detroit Ship Building Co....Detroit.
Fore River Ship Building Co.......Quincy, Mass.
Great Lakes Engineering Works....Detroit.
Lockwood Mfg. Co..............East Boston, Mass.
Manitowoc Dry Dock Co..................Manitowoc, Wis.
Maryland Steel Co.............Sparrow's Point, Md.
Milwaukee Dry Dock Co....... Milwaukee.
Newport News Ship Building Co...............Newport News, Va.
New York Shipbuilding Co...................Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co..Chicago.
Toledo Ship Building Co......Toledo.

SHIP CHANDLERS.
Baker, Howard H. & Co....Buffalo.
Marine Mfg. & Supply Co....... New York.
Upson-Walton Co........Cleveland.

SHIP DESIGNERS.
Kidd, Joseph ....Duluth.
Steel, Nacey, & Hynd....Cleveland.
Wood, W. J................Chicago.

Buyers' Directory of the Marine Trade---*Continuea.*

SHIP LANTERNS AND LAMPS.
Upson-Walton Co.......... Cleveland.

SHIP TIMBER.
Martin-Barriss Co.........Cleveland.

SMOOTH-ON COMPOUND, FOR REPAIRS.
Smooth-On Mfg. Co..................................Jersey City, N. J.

STAYBOLT IRON OR STEEL BARS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.........................Cuyahoga Falls, O.

STEAM VESSELS FOR SALE.
Holmes, Samuel ....New York.
McCarthy, T. R.....Montreal, Can.

STEAMSHIP LINES, PASS, AND FREIGHT.
American Line ....New York.
Anchor Line ....Buffalo.
Boston Steamship ....Boston.
C. & B. Transit Co...........Cleveland.
International Mercantile Marine Co. .... Philadelphia.
Mallory Line ....New York.
New York & Cuba Mail S. S. Co.. ....New York.
Red Star Line ....New York.

STEAM SPECIALTIES.
Robertson, Jas. L. & Sons ..New York.

STEEL CASTINGS.
Otis Steel Co............Cleveland.
Sutton Co., C. E.........Toledo, O.

STEERING APPARATUS.
American Ship Building Co................................Cleveland.
Chase Machine Co.......Cleveland.
Dake Engine Co.................................Grand Haven, Mich.
Detroit Ship Building Co....Detroit.
Hyde Windlass Co........Bath, Me.
Marine Mfg. & Supply Co..........................New York.
Sheriffs Mfg. Co........Wilwaukee.

SUBMARINE DIVING APPARATUS.
Morse & Son, A. J..........Boston.
Schrader's Son, Inc. A....New York.

SURVEYORS, MARINE.
Hynd, Alexander ....Cleveland.
Parker Bros. Co., Ltd......Detroit.
Nacey, James ....Cleveland.
Steel, Adam ....Cleveland.
Wood, W. J...............Chicago.

TESTS OF MATERIALS.
Hunt, Robert W. & Co....Chicago.
Lunkenheimer Co....Cincinnati, O.

THERMIT
Goldschmidt Thermit Co., ... New York City.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Watson-Stillman Co......New York.

TOOLS, WOOD WORKING.
Atlantic Works, Inc....Philadelphia.

TOWING MACHINES.
American Ship Windlass Co...........................Providence, R. I.
Chase Machine Co.......Cleveland

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.. ....Kingston, Ont.
Great Lakes Towing Co..Cleveland.

TRUCKS.
Boston & Lockport Block Co...... .... Boston.

TUBING, SEAMLESS.
Shelby Steel Tube Co..Pittsburg, Pa.

VALVES, STEAM SPECIALTIES, ETC.
Jenkins Bros. ....New York
Lunkenheimer Co........Cincinnati.
Ross Valve Co.........Troy, N. Y.

VALVES FOR WATER AND GAS.
Ashton Valve Co.,..........Boston.
Lunkenheimer Co........Cincinnati.
Republic Belting & Supply Co...... ....Cleveland, O.
Ross Valve Co........Troy, N. Y.

VENTILATING APPARATUS FOR SHIPS.
Sutton Co., C. E.........Toledo, O.

VESSEL AND FREIGHT AGENTS.
Boland, John J.............Buffalo.
Elphicke, C. W. & Co......Chicago.
Hall, John B................Buffalo.
Helm & Co., D. T..........Duluth.
Hawgood & Co., W. A....Cleveland.
Holmes, Samuel ....New York.
Hutchinson & Co.........Cleveland.
McCarthy, T. R...........Montreal.

VESSELS AND FREIGHT AGENTS—Con.
Mitchell & Co............Cleveland.
Parker Bros. Co., Ltd......Detroit.
Prindiville & Co............Chicago.
Richardson, W. C.........Cleveland.
Sullivan, D. & Co..........Chicago

WATER GAUGES.
Lunkenheimer Co.....Cincinnati, O.

WHISTLES, STEAM.
Lunkenheimer Co........Cincinnati.

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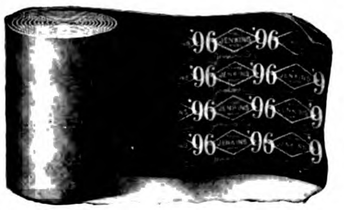
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